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Arizona Department of Mines and Mineral Resources Mining Collection

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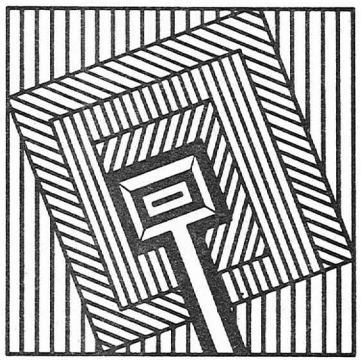


ANACONDA®

TWIN BUTTES, ARIZONA

A TOUR OF ANACONDA TWIN BUTTES MINE

1. THE MINE ENTRANCE affords an excellent frontal view of the Alluvium (sand and gravel) dikes, terraced and planted with shrubs and grasses.

2. INSIDE THE MINE PROPERTY the dikes are 200 feet high and the steep slope makes them susceptible to erosion. The dikes here are not terraced.

3. THE MINE SHOP AREA is the nerve center of the entire Twin Buttes operation and its 1000 employees. The offices are located here along with the maintenance area for all the major equipment.

4. DIKES constructed with the Alluvium overburden removed from the pit area form tailing ponds where mill waste is impounded and from which water is recovered for re-use.

5. LANDSCAPING together with irrigation and fertilizing is required to transform the dikes from mountains of barren waste to verdant hillsides, blending into the natural desert beauty of the surrounding Santa Cruz Valley.

6. OBSERVATION AREA provides a breathtaking view of the pit area, 4000 feet from left to right and 6000 feet long. The 100 ton bottom dump trucks appear as toys from this vantage point.

7. THE ALLUVIUM CONVEYOR is located on the east wall. As the pit is expanded the conveyor removes the overburden at the rate of 8000 tons per hour. This expansion will continue for the life of the mine, which is estimated to extend possibly into the next century.

8. PIT FLOOR is currently at a depth of 750 feet. Ultimate depth is 1800 feet! Down here the trucks no longer appear as toys.

9. ORE and ROCK CONVEYOR runs up the west wall at a speed of 950 feet per minute. Primary ore crusher is located near the bottom of this conveyor system and grinds the ore to medium size.

10. WASTE ROCK DISPOSAL AREA is fed by one branch of the conveyor system. After every blast in the pit, the Ore Control Engineer analyzes samples and determines whether the rocks will go to the waste area or the concentrator.

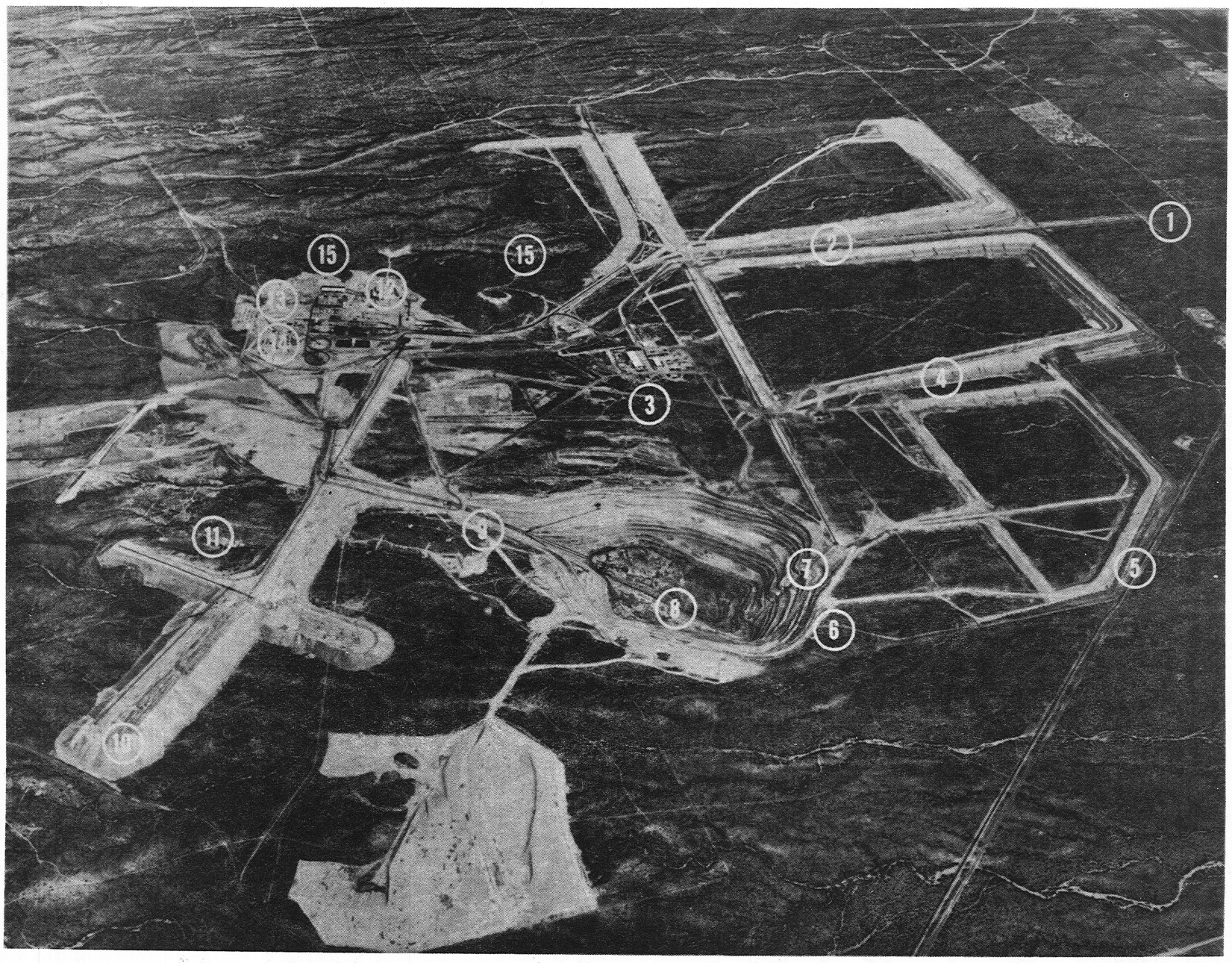
11. THE ORIGINAL TWIN BUTTES VILLAGE came into being 100 years ago when prospectors found rich outcrops of copper ore in the area. It wasn't long until these rich, easy-to-mine pockets of ore were mined out and the village was abandoned.

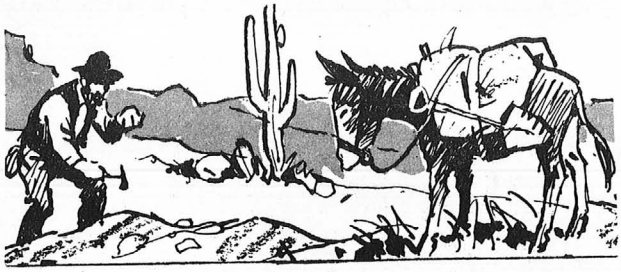
12. THE FINE ORE CRUSHER is located next to the concentrator and grinds the ore into a heavy gravel suitable for introduction into the concentrator.

13. IN THE CONCENTRATOR the grinding section reduces the rocks to a very small size. The brassy colored copper minerals are then separated from the waste in flotation cells.

14. THICKENERS, circular in shape, receive the brassy-yellow colored mixture and remove the excess water. The concentrate is then dried and is ready for shipment to a smelter. 100 pounds of ore produces about 2 pounds of concentrate and this in turn will produce a little over one-half pound of copper.

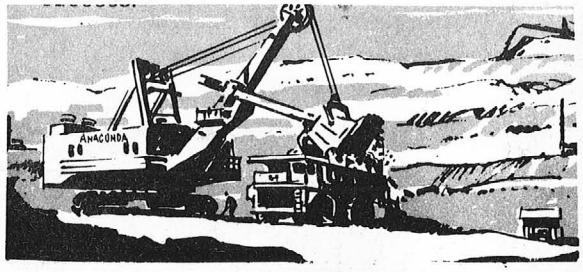
15. TWIN BUTTES, from which the original village and the current mine draw their names, stand watch over the entire area.





1870

THE TWIN BUTTES STORY



1970

Copper mining in this area had its beginnings in the 1870's when prospectors found rich outcrops of copper ore. It wasn't long until these rich, easy to mine pockets of ore were mined out.

In the early 1900's the copper mines near Twin Buttes enjoyed a brief return to productivity. Copper prices were good, optimism was high to the degree that a railroad line was built from Tucson to service this area. This rebirth of mining activity was short lived, however, and it wasn't until the 1950's that new interest was shown in this mining district. Modern day prospectors, geologists and engineers armed with the most up-to-date tools for divining the secrets of the earth began an intensive exploration of the district, hoping to find areas of mineralization suitable for mining.

In 1963 The Anaconda Company and the Banner Mining Company entered a long-term lease agreement for the exploration and development of Banner properties.

Shortly thereafter, an extensive program of diamond drilling was undertaken to develop the limits of what was possibly a large, low-grade ore body and to provide information as to the expected grade of the mineralization.

Engineers undertook the task of designing the mine and conducted economic studies to determine the best mining method...a task of unbelievable complexity!

Following this, an underground shaft was sunk for the purpose of acquiring additional geologic data. This also provided large, bulk samples of mineralized material for processing through a pilot plant to determine the most efficient method of removing the metal from the rock.

In making the decision to mine the ore by open pit methods, many factors had to be considered. One of the most significant was the fact that the ore body is overlain by 460 feet of sand and gravel. Anaconda was faced with the biggest pre-production stripping job in copper mining history anywhere in the world--a job that involved the removal of more than 200,000,000 tons of material before getting into the ore body in the underlying hard rock. It was decided to strip this overburden by means of scrapers, belt conveyors and bottom dump trucks.

Ore and rock are mined by 15 cubic yard electric shovels, loaded into 100-ton capacity end dump trucks and hauled to the primary crushers deep in the pit.

Belts carry ore to the surface for treatment in a multimillion dollar concentrator. Other belts convey waste rock to disposal areas.

All of this complex operation is designed to mine ore that averages less than six tenths of 1% copper, or less than 12 pounds of copper per ton. In the development and mining of this ore body the lowest possible costs must be achieved for a successful operation. A tremendous expenditure of money was made before a single pound of copper concentrate was produced, and it will take many years to recover this investment.

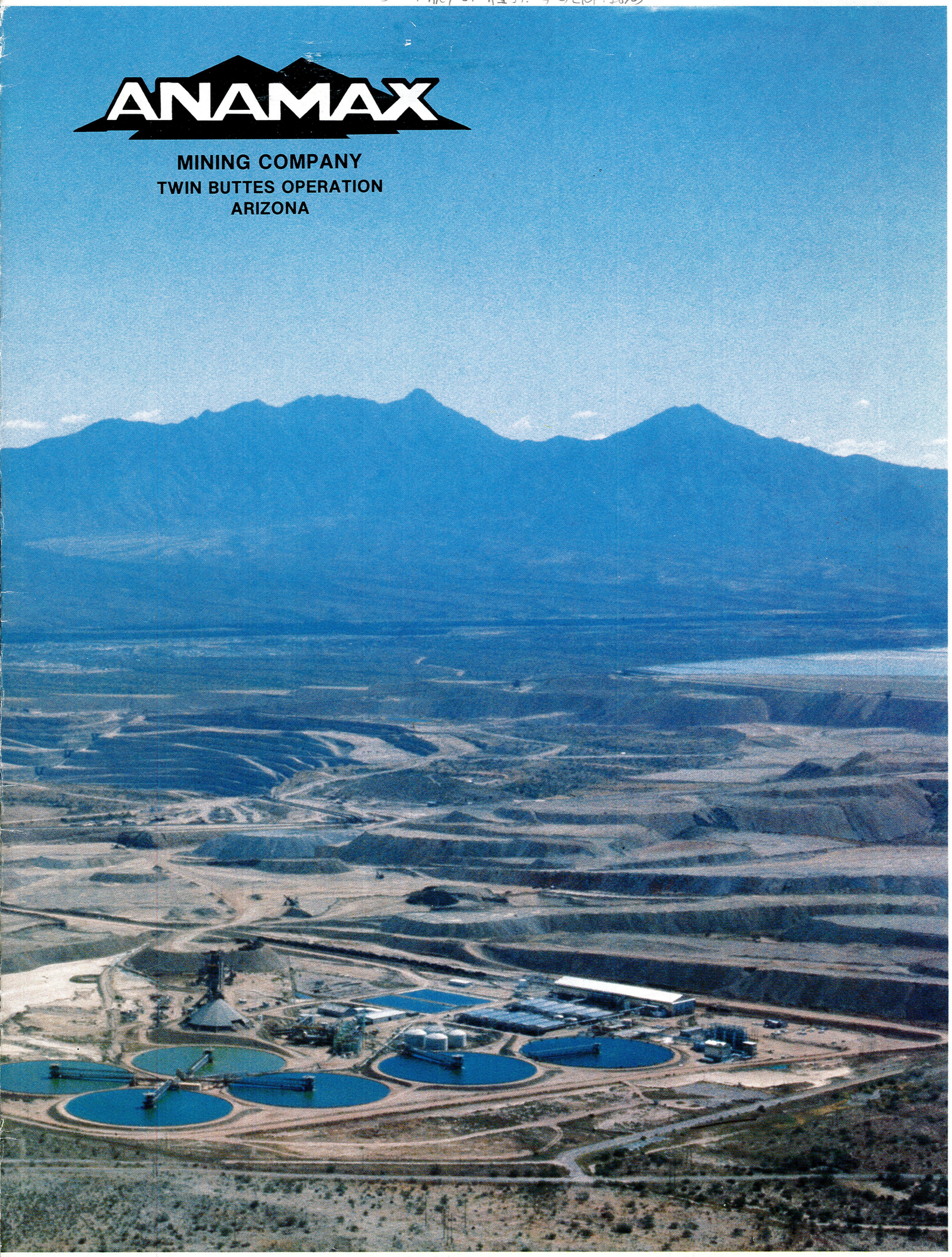
The application of the most advanced technology plus the interest, enthusiasm and cooperation of the men and women working for Anaconda are our best guarantees for success.

SUMMARY OF HIST. + OPERATIONS

ANAMAX

MINING COMPANY

TWIN BUTTES OPERATION
ARIZONA



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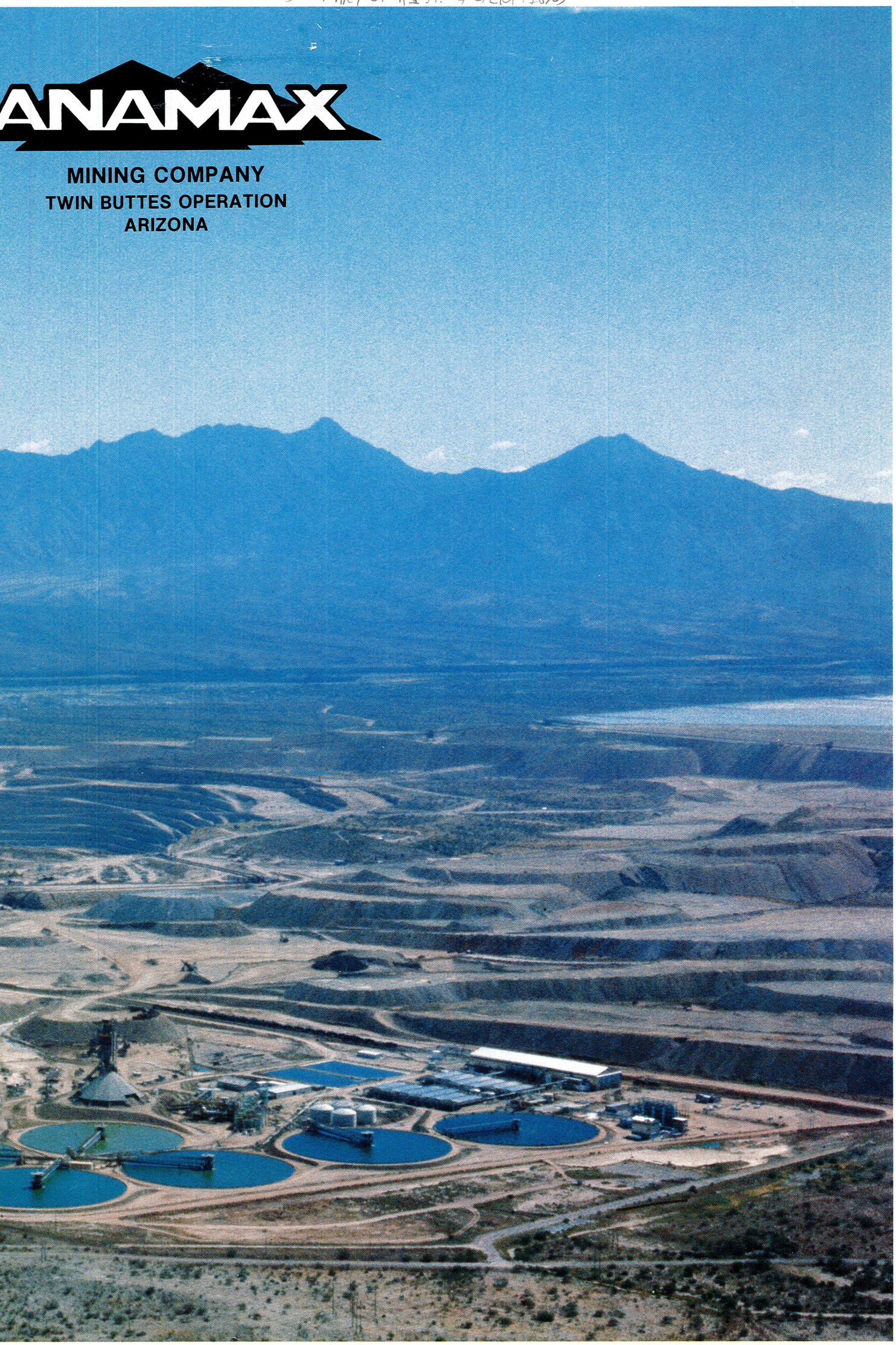
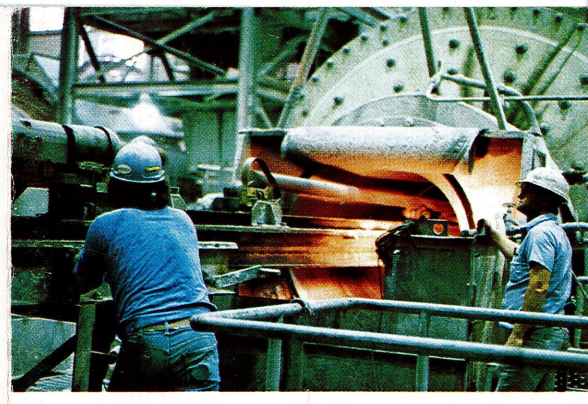
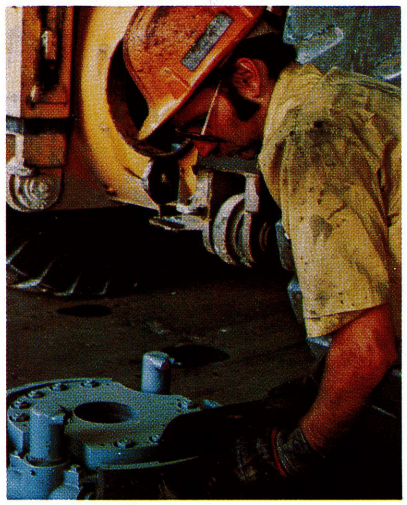
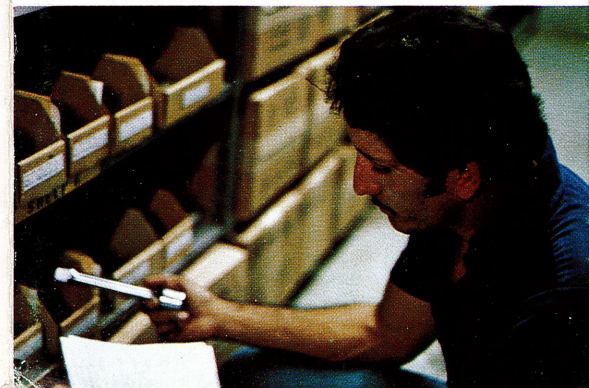




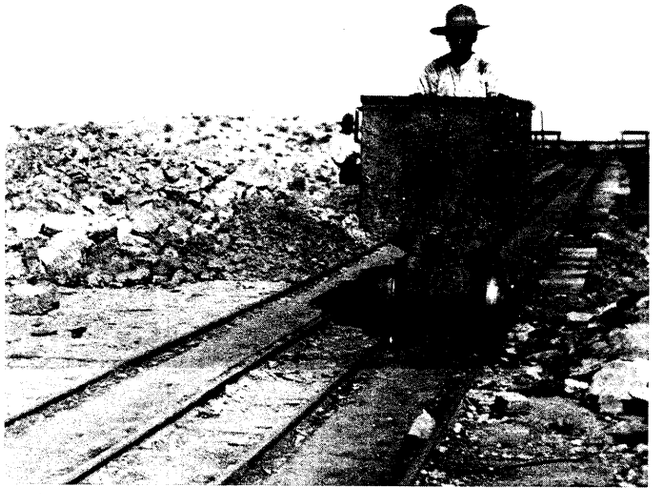




The Twin Buttes Story

Copper mining in the Pima Mining District of southern Arizona had its beginnings in the 1870s when prospectors found rich outcrops of copper ore. In the area known as Twin Buttes, many small mining operations flourished and failed.

The Banner Mining Company reactivated mining in the Twin Buttes area during the 1950s and gained extensive mineral holdings here over the next several years. In 1965, The Anaconda Company, under agreement with Banner, began an exploration and mining project far beyond the scope of those early day mines.



Arizona Historical Society

Miner and ore car at Twin Buttes, Arizona Territory.

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.

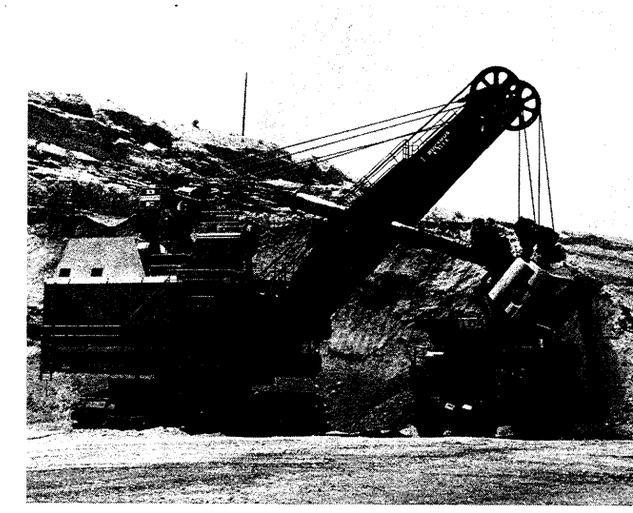
Arizona Historical Society

Workers pose at Twin Buttes smelter, 1912.

An agreement by Anamax and ASARCO, Inc., in 1976, designates ASARCO as operator for the development and mining of the nearby Palo Verde copper property. A feature of this operation, known as the Eisenhower Project, is the 6.4-mile overland conveyor system for transporting ore to the Twin Buttes Mine for processing.

Hard Rock Mining

Anamax' 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.



Huge 34-yard electronic shovel loads alluvium into end dump truck.

True to modern mining methods, Anamax 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 1¾ miles long, 1¼ 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, 12½ inches in diameter, are drilled at 30 foot intervals and loaded with explosives.

Blasting in Anamax pit loosens and fractures ore and rock.

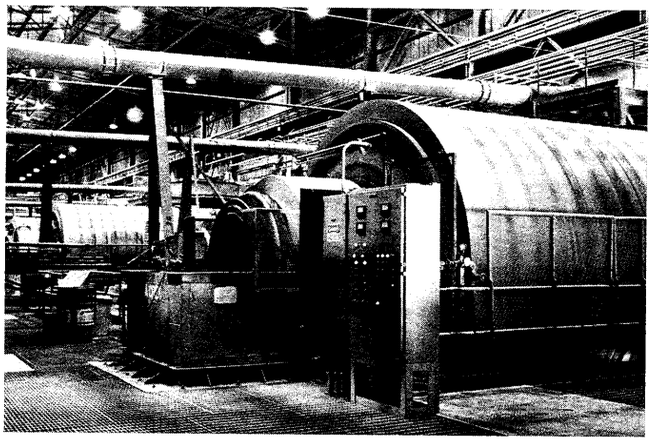
Once the ore and rock have been loosened and fractured by blasting, electric power shovels move in to load it onto 100- and 170-ton end-dump trucks. These trucks carry the ore and rock to one of three crushers in the pit which reduce it to a size that can be carried on five foot wide conveyor belts, up and out of the pit to processing points on the property or to waste.

Copper Recovery

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

The Sulfide Mill

The Twin Buttes Sulfide Mill has the capacity to process 40,000 tons of ore per day, yielding 1200 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 which eventually reduce it to a pebble size. The fine ore then is moved by conveyor to the Sulfide Concentrator, where it is fed into a series of rod and ball grinding mills (shown above).

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 long steel rods, four inches in diameter and 17 feet long. The ball mills are slightly larger and are filled with 2-inch diameter steel balls. 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 black powder, the concentrate is shipped to copper smelters for further refining.

The Oxide Plant

The Anamax 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 mills and reduced to a slurry which is then pumped through a series of eight leaching tanks.[1] 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 tanks[2] 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 extraction[3] 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 tankhouse[4], 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, 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.

In the ores at Twin Buttes, copper content varies from .6 of one per cent to 1.5 per cent; about 100 tons of ore are required to produce one ton of copper.

In the same 100 tons of ore, other metals are present which can be feasibly extracted as by-products. Almost since the beginning of its operations, Anamax has recovered large quantities of molybdenum, a metal used by the steel industry to produce high-temperature-tolerant alloys for the aerospace industry. A recent pilot plant project has proven a recovery process for tungsten, which may be implemented in a few years when ore being mined is expected to contain more tungsten than that currently being mined. This rare metal is used in welding and in high-test tools and dies. Early in 1980, Anamax began recovering uranium. The uranium content in the ores at Twin Buttes is low — only 35 parts per million, compared with 1,000 to 10,000 parts per million in a working mine.

A sulfuric acid solution containing copper and uranium, from the thickening stage of the oxide process, is pumped through columns filled with resin beads. Here, uranium is absorbed into the resin beads, while copper, still in solution, continues unaffected along the normal copper recovery route. The resin beads then are rinsed with a stronger sulphuric acid solution to remove the uranium.

Recovered uranium then is concentrated into an ammonium sulfate solution by a process called solvent extraction. Ammonia is added to the concentrated solution to precipitate the uranium as a slurry. Uranium slurry is further processed to remove water. The final product is a dried, powdered form of processed uranium called yellowcake. It is packed into 55-gallon drums for shipping to processing points elsewhere in the country.

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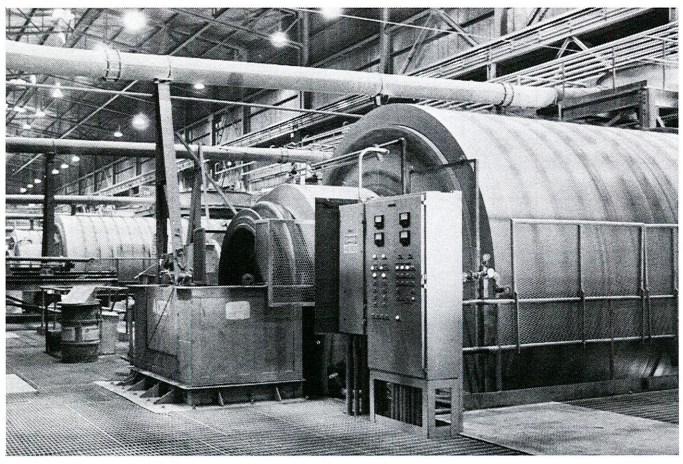

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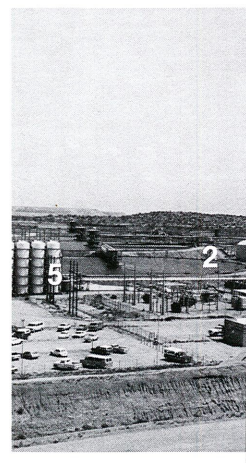

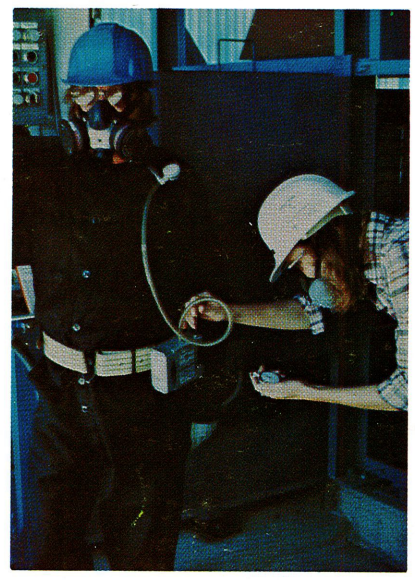

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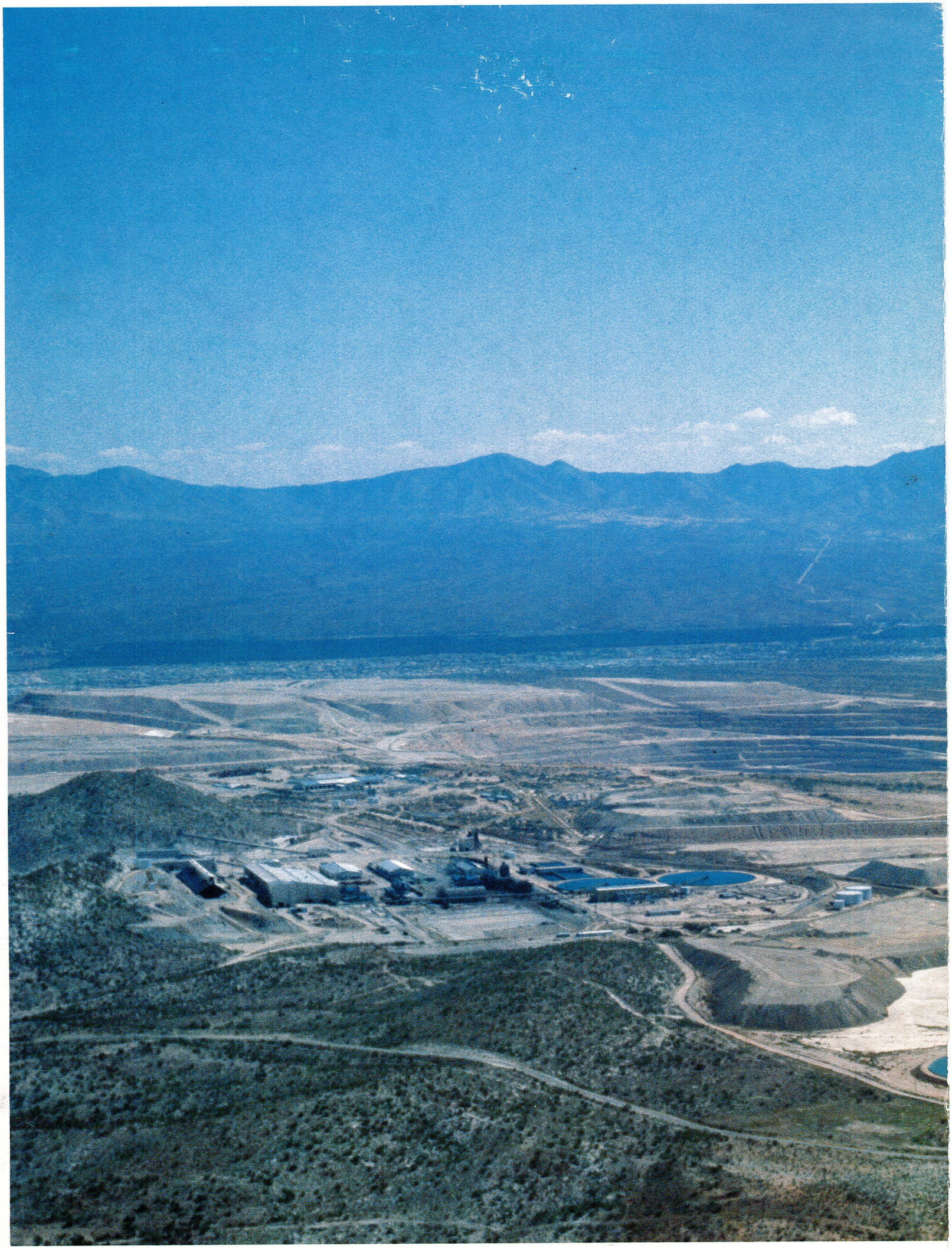
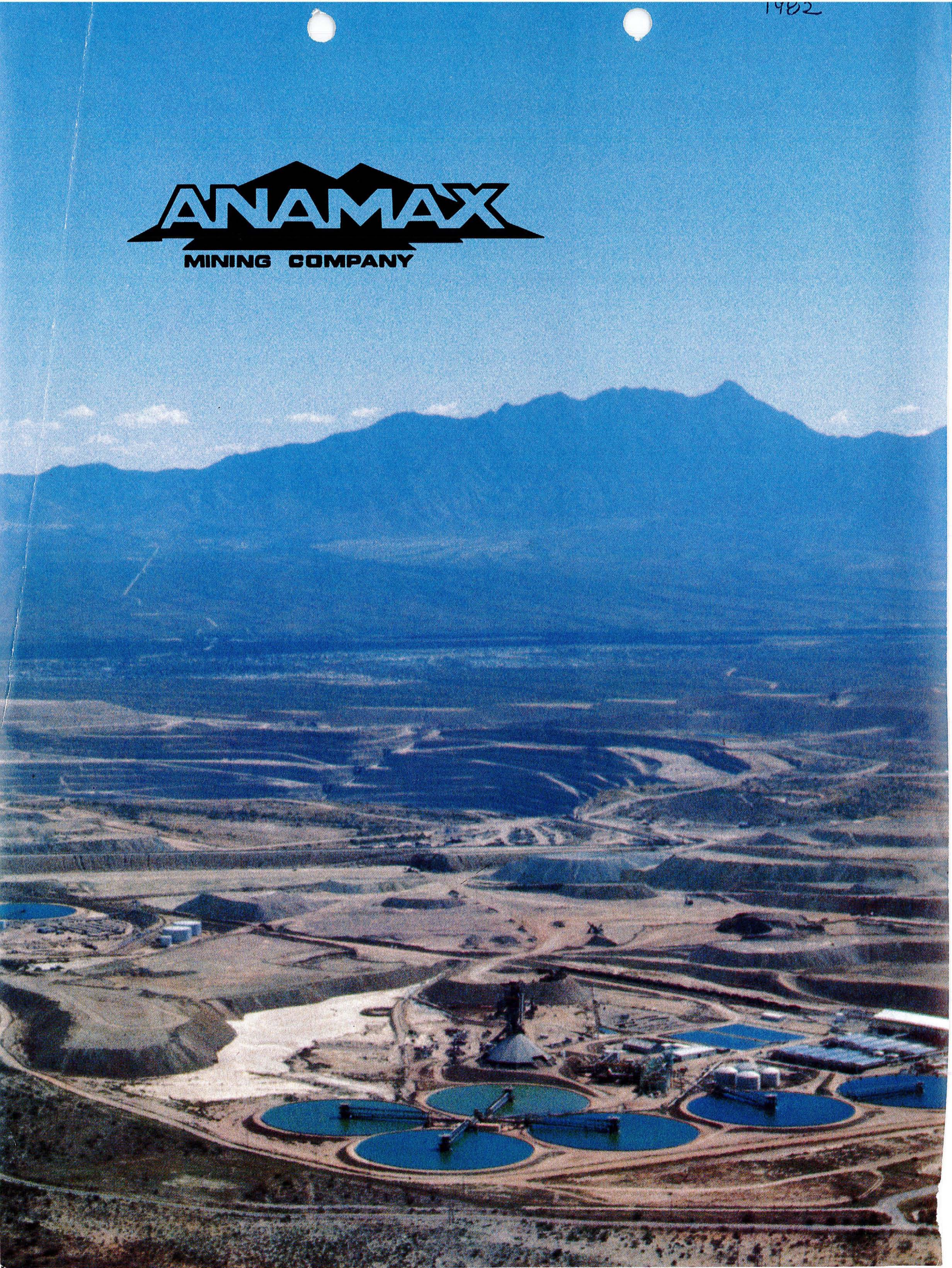


1982

ANAMAX

MINING COMPANY



Picture perfect checking.

When you open a Valley National Bank checking account, you can get a lot more than just a checking account.

You can also get a Valley National Banking Card.

The Valley National Banking Card is the ultimate check guarantee card. Because it's the only one in Arizona that has your picture on it.

Use it as a check guarantee or as a check substitute at more than 20,000 participating Arizona merchants.

And it gives you access to more than 60 Valley National Banking Machines throughout the state.

That's why we call it picture perfect checking.

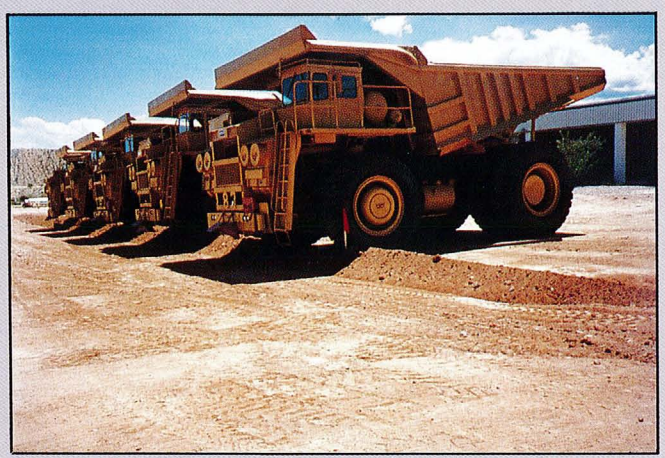
Open a Valley Bank checking account and apply for a Valley National Banking Card at any of our more than 200 neighborhood Valley Bank offices.

We go out of our way for you.
Valley National Bank

Deposits insured to $100,000 by Federal Deposit Insurance Corporation.

HAULAGE TRUCKS

9 Terex 33-15 and **6** Terex 33-15B 170 ton rear dump trucks. Detroit Diesel 16V 149T1 engine; GM generator with 2 GM traction motors; tire size 36.00 x 51 58 PR.



5 Wabco 120B 120 ton rear dump trucks. Detroit Diesel 12V 149T1 engine, GE 772 wheel motors; tire size 27.00 x 49 42 PR.

18 KW Dart 110 ton rear dump trucks. Detroit Diesel 12V 149T1 engine, Allison DP8960 or 8961 6-speed transmission with electric shift; tire size 27.00 x 49 42 PR.

PARK CORPORATION
P.O. BOX 1488 GREEN VALLEY, ARIZONA 85622 (602) 648-1630
MINE EQUIPMENT DIVISION

Terex 33-15 & 33-15B 170 Ton Haulage Trucks

Location: Kaiser Steel's Iron Ore Mine ***Eagle Mountain, California***

ID#	s/n	ENGINE HOURS	MAIN GENERATOR HOURS	AUXILIARY GENERATOR HOURS	G.M. TRACTION MOTOR, R-H HOURS	G.M. TRACTION MOTOR, L-H HOURS
Model-3315						
601	C2339	2,377.7	11,743.9	11,743.9	4,722.1	3,079.5
602	C2340	3,965.5	3,965.5	29.1	5,884.8	6,013.4
603	C2341	1,957.7	2,735.1	3,149.4	11,224.7	11,224.7
604	C2342	2,304.0	2,304.0	2,304.0	711.8	3,276.8
605	C2343	3,402.7	17,073.1	3,233.1	8,399.6	8,399.6
606	C2344	307.7	307.7	307.7	158.1	446.1
607	C2345	1,067.9	1,067.9	1,067.9	1,067.9	1,067.9
608	C2346	1,729.3	7,557.8	2,475.4	404.7	404.7
609	C2349	4,152.6	4,270.3	4,270.3	101.8	101.8
Model-3315B						
610	C2400	3,864.1	3,864.1	994.7	1,535.1	1,535.1
611	C2401	11,945.3	11,945.3	329.6	2,148.1	4,318.4
612	C2402	6,496.0	11,126.1	504.3	5,917.4	5,917.4
613	C2403	5,718.7	19,454.3	1,779.7	215.0	00.0
614	C2404	787.7	787.7	787.7	113.5	35.4
615	C2405	1,590.3	1,590.3	44.7	8,530.2	10,025.6

WABCO 120B Haulage Trucks

Location: Anamax Twin Buttes Mine ***Green Valley, Arizona***

ID#	s/n	ENGINE HOURS	RT. WHEEL ARM/MOTOR HOURS	LF WHEEL ARM/MOTOR HOURS	GENERATOR HOURS
N52	GF53888AFE5BS	2,958	10,197	8,240	5,475
N87	GF 5097AFE5X	2,872	3,267	4,828	4,828
N92	*GF 5102AFE5X	4,651	3,337	310	5,000
N94	GF5354AFE5BP	5,562	3,796	4,956	11,359
N98	GF5381AFE5BP	—	12,916	8,327	10,068

*GF5102AFE5X has Unit Rig gear sets w/Reliance wheel motors and G.E. electrics

K.W. Dart 110 Ton Rear Dump Trucks

Location: Kaiser Steel's Iron Ore Mine ***Eagle Mountain, California***

ID#	s/n	ENGINE HOURS	TRANS HOURS	DIFF HOURS
	MODEL D2771:			
442	67106-2	3,950	3,740	16,072
453	68183	7,781	5,408	1,638
454	68184	8,947	145	6,723
455	68185	6,539	5,542	9,246
456	68186	3,703	8,476	1,925
457	68187	8,455	9,078	14,109
458	68188	5,469	1,319	5,517
	MODEL D2772:			
468	70133	3,155	3,155	1,119
469	70134	4,026	14,833	3,971
472	70137	5,522	6,607	6,344
473	70138	4,410	10,848	1,048
480	70211	8,826	3,510	606
483	70214	2,127	904	9,615
484	70215	7,975	1,933	8,898
487	70218	5,903	4,717	2,162
488	70219	4,258	1,858	3,159
489	70220	1,741	7,539	11,861
490	70221	4,262	1,300	353

ELECTRIC SHOVELS

25 shovels: bucket capacities ranging from 3.5 cu yards to 18 cu yards.

SHOVELS

ID#	Make	s/n	Year	Type	Size	Powered
Kaiser Steel's Iron Ore Mine		**Eagle Mountain, California**				
39	P & H	39975	1976	2300	18 yd	electric
38	Marion	23008	1973	192M	17 yd	electric
35	Bucyrus Erie	129537	1965	280B	12 yd	electric
32	Bucyrus Erie	11853	1957	190B	8 yd	electric
30	Bucyrus Erie	117901	1957	190B	8 yd	electric
29	Bucyrus Erie	125749	1965	280B	12 yd	electric
28	Bucyrus Erie	125748	1965	280B	12 yd	electric
27	Bucyrus Erie	124487	1965	280B	12 yd	electric
37	Bucyrus Erie	89334	1954	150B	6 yd	electric
25	Bucyrus Erie	110873	1954	150B	6 yd	electric
Anamax Twin Buttes Mine		**Green Valley, Arizona**				
S13	P & H	35550	1973	2100BL	15 yd	electric
S12	P & H	34720	1972	2100BL	15 yd	electric
S10	P & H	30880	1969	2100B	15 yd	electric
S09	P & H	30870	1969	2100B	15 yd	electric
S08	Marion	22841	1968	191M	15 yd	electric
S07	Marion	22825	1967	191M	15 yd	electric
S06	Marion	22824	1967	191M	15 yd	electric
S11	P & H	30040	1968	1900B	10 yd	electric
S04	Northwest	26706-46509B	1975	180D	5 yd	diesel
Stelco's Griffith Iron Ore Mine		**Red Lake, Ontario, Canada**				
06	Bucyrus Erie	136005	1975	150B	6½ yd	electric
05	Bucyrus Erie	133914	1973	150B	6½ yd	electric
03	Bucyrus Erie	127932	1966	150B	6½ yd	electric
02	Bucyrus Erie	127905	1966	150B	6½ yd	electric
01	Bucyrus Erie	127904	1966	150B	6½ yd	electric
04	Bucyrus Erie	100504	1958	150B	6½ yd	electric

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ELECTRIC AND DIESEL/ ELECTRIC DRILLS

15 Blast hole rotary drills

DRILLS

ID#	Make	Year	s/n	Type	Powered	Total Hrs	Date of Last Major Overhaul
Location: ***Kaiser Steel's Iron Ore Mine***				***Eagle Mountain, California***			
2037	Bucyrus Erie	1974	134750	60R	electric	24,755	1979
2036	Bucyrus Erie	1973	133772	60R	electric	32,190	1979
2035	Bucyrus Erie	1972	133107	60R	electric	36,358	1978
2034	Bucyrus Erie	1972	133103	60R	electric	38,001	1978
Location: ***Anamax Twin Buttes Mine***				***Green Valley, Arizona***			
S58	Gardner-Denver	1975	1027	GD-120	diesel/electric	12,782	original
S57	Gardner-Denver	1975	1026	GD-120	diesel/electric	11,309	original
S56	Bucyrus Erie	1973	134519	60R	diesel/electric	20,888	12/80
S55	Bucyrus Erie	1972	133295	60R	diesel/electric	23,303	12/79
S51	Bucyrus Erie	1967	129269	60R	diesel/electric	11,951	original
S50	Bucyrus Erie	1967	128751	60R	diesel/electric	37,003	11/81
Location: ***Stelco's Griffith Iron Ore Mine***				***Red Lake, Ontario, Canada***			
	Atlas Copco	1981	BRE-1072A	ROC-810H	diesel		
	Gardner-Denver	1973	1007	GD120	electric		
	Gardner-Denver	1972	1003	GD120	electric		
	Bucyrus Erie	1966	128689	45R	electric		
	Bucyrus Erie	1965	127928	40R	electric		

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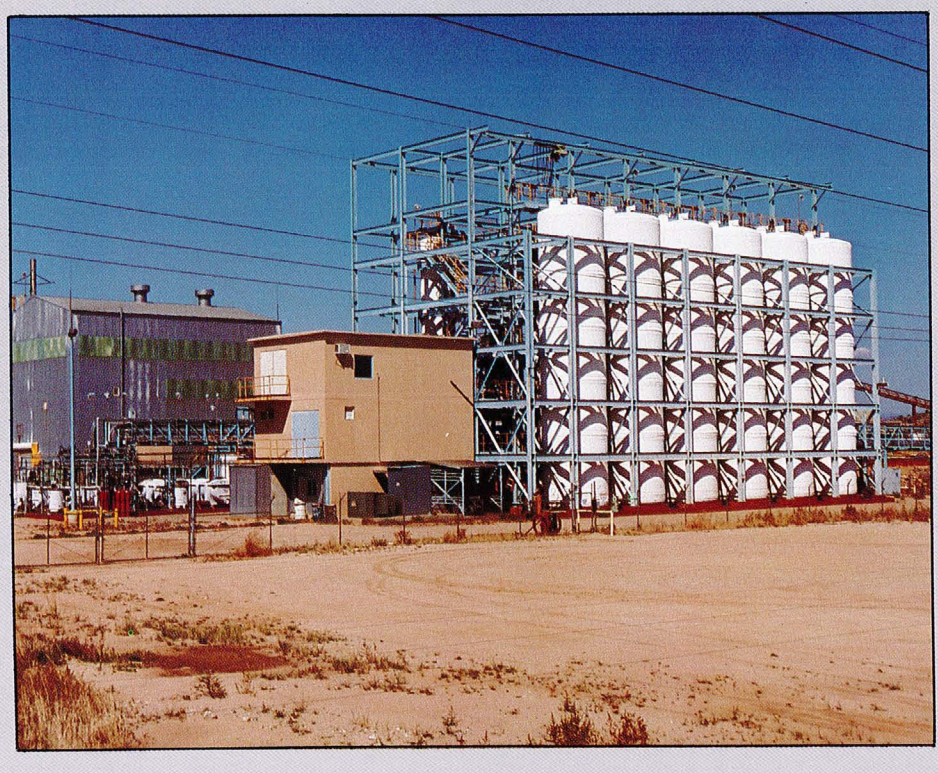
Uranium Plant

Anamax Twin Buttes Mine
Green Valley, Arizona



The uranium plant was designed for 7000 gph flow rate with 6-10 ppm U_3O_8 feed grades. The solution is passed through a resin ion exchange section consisting of six absorption columns, three elution columns and transfer vessels for moving resin. Each absorption column has five compartments, four of which contain 200 cu ft of resin each. The resin is advanced to the elution column when it becomes loaded and a fresh eluted batch of resin is introduced at the top of the column.

The pregnant solution from the resin ion exchange is then fed into a solvent extraction section consisting of four extraction mixer settlers, one scrub mixer settler and three stripper mixer settlers.

The pregnant solution from solvent extraction is then fed into a two stage

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precipitation tank. The precipitated yellow cake is then dewatered in a thickener and fed into a centrifuge and dried in a four hearth dryer and loaded into barrels.

Total design production of the plant was 500 pounds/day.

Equipment:

6 - absorption columns, 12' diameter, 53' high, constructed from FRP with ¼" thick corrosion liner of ATLac 382-4010A Bisphenol polyester resin. The columns contain 5 chambers separated by conical baffles and inverted weirs.

3 - Elution Columns, 6' diameter, 50'6" high constructed from FRP with ¼" thick corrosion liner of ATLac 382-4010A Bisphenol polyester resin with structural laminate made of Isophthalic Ash Load 7532.

3 - Measuring chambers, 8' diameter, 10' high constructed of 316 SS with a design working pressure of 50 PSI. There are 2 inspection windows, 3"x8" each.

3 - Rinse chambers, 8' diameter, 8' high constructed of 316 SS with a design working pressure of 50 PSI.

1 - Barren Surge Tank, 10' diameter, 15' high, FRP construction with corrosion liner of ATLac 4010A resin.

1 - Tails Waste Tank, 10' diameter, 10' high constructed of FRP with corrosion line of ATLas 4010A resin.

1 - Scrub Waste Tank, 2' diameter, 2' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - Raffinate tank, 10' diameter, 10' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - Raffinate Transfer Tank, 4' diameter, 4'6" high, FRP construction with corrosion layer of 4010A resin.

1 - Pregnant Eluant Tank, 20' diameter by 18' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - Barren Eluant Tank, 20' diameter, 15' high, FRP construction with corrosion layer of ATLas 4010A resin.

1 - Dilute Acid Tank, 10' diameter, 15' high, FRP construction with corrosion layer of ATLas 4010A resin.

1 - Acid Wash Waste Tank, 20' diameter, 15' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - Decision Tank, 10' diameter, 10' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - Barren Strip Tank, 6' diameter, 4.5' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - Barren Organic Tank, 6' diameter, 6' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - Pregnant Solution Tank, 6' diameter, 6.5' high, FRP construction with corrosion layer of ATLac 4010A resin.

1 - IPAC Series 3000 master controller, 32K EPOM-24K RAM, 3 serial ports, 1- series 3000 master controller, 32K EPROM, 24K RAM, 6 serial ports, 2 analog to digital converters with model 100 Teleray terminal, and Techtron model 951 floppy disk drive.

2 - Durco Mark II, 1½x1x8 horizontal pump, Durimet 20 construction with 2hp 3/60/460, 1800 rpm motor.

2 - Galigher model 1.5 SSSA2100x48" vertical pump with 2hp 460/3/60, 1800 rpm motor.

5 - Galigher model 2.5 SSSA100x60" vertical pump with 3hp 460/3/60, 1800 rpm motor.

2 - Galigher model 2.5 SSSA100x60" vertical pumps with 5hp 460/3/60, 1800 rpm motors.

1 - Galigher model 2.5 SSSA100x48" vertical pump with 5hp 460/3/60, 1800 rpm motor.

1 - Galigher model 2.5 SSST400x132" vertical pump with 3hp, 460/3/60, 1800 rpm motor.

1 - Galigher model 2.5 SSST400x132" vertical pump with 7.5p, 460/3/60, 1800 rpm motor.

1 - Galigher model 2.4 SSST400x132" vertical pump with 10hp, 460/3/60, 1800 rpm motor.

12 - Durco Mark II, 6x4x13AV10.5 horizontal pumps, material CD4M, with 30hp, 460/3/60, 1800 rpm motors.

3 - Durco Mark II, 3x2x10 horizontal pumps, material CD4M, with 15hp, 460/3/60, 1800 rpm motors.

1 - Durco Mark II 4x3x10 horizontal pumps, material CD4M with 15hp, 460/3/60, 1800 rpm motor.

2 - Allis Chalmers, 4x3x8.5 C5O horizontal pumps with 3hp, 460/3/60, 1800 rpm motors.

2 - Allis Chalmers, 6x4x13 series 2000 pump with 40hp, 460/3/60, 1800 rpm motors.

2 - Allis Chalmers, 1.5x1x8 C5O pump with 3hp, 460/3/60, 1800 rpm motors.

2 - Allis Chalmers 1.5x1x6 C5O pumps with 1hp, 460/3/60 1800 rpm motors.

1 - Allis Chalmers 1.5x1x6 C5O pump with 1.5hp, 460/3/60, 1800 rpm motor.

2 - Hazleton 10' diameter DN model V6 vertical pumps, 316SS construction with 200hp, 460/3/60, 1800 rpm motors.

1 - Robbins & Meyer Moyno pump, model 3L6-SSG with 316 SS case and screw and Reeve variable speed 2 hp motor.

1 - Robbins & Meyer Moyno pump model 2FGJ6-SSR with 316 SS case & screw and Reeves variable speed 2hp motor.

1 - SX Plant (complete) consisting of 4-6' wide, 24' long extraction settlers with pump mixers, 3-4' wide, 10'9" long stripper settlers with pump mixer and 1-4' wide x 10'9" long scrub settler with pump mixer. All wetted parts FRP construction.

1 - Door Oliver, 10' diameter thickener mechanism type AA. All mechanism wetted parts 316 SS. Tank is 9'6" total center depth FRP construction.

1 - Door Oliver Mercobowl Centrifuge, model 9L. All wetted parts 316 SS with 15hp, 460/3/60, 1800 rpm drive motor.

1 - Mine & Smelter Skinner, 4 hearth dryer, propane fired, with rabble arms advance, wet 316 SS scrubber.

1 - Barrel Loadout system including conveyor and Leeweight series 5000 scale with electronic printer.

1 - Ducon wet scrubber size 36 ULO-Y model 1VHE fabricated 316 SS with 25hp 460/3/60, 1800 rpm motor.

OXIDE PLANT

Anamax Twin Buttes Mine
Green Valley, Arizona

This 10,000 DST per day oxide plant was opened in August of 1975 and operated until October 1985.

It consists of three facilities:

I. Crushing
II. Grinding, Leaching and Thickening
III. Copper Solvent Extraction and Electrowinning

These will be outlined separately in detail.

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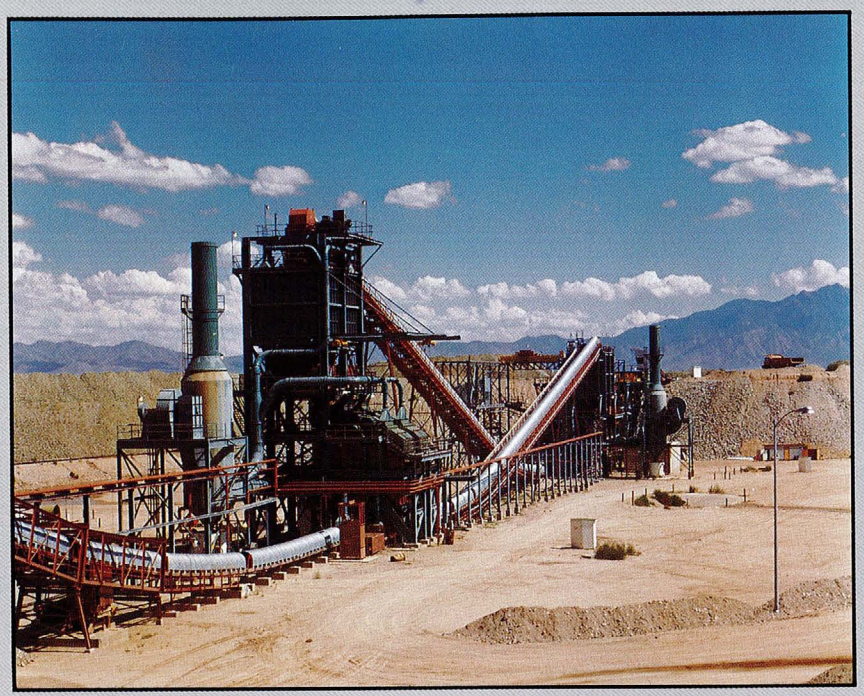
I. Crushing



The Oxide crushing unit was designed to process either mine run ore or product from the primary crushers at a rate of 1000 tons per hour. The ore is fed into a 200 ton dump pocket, reclaimed by a pan feeder into a 48"x60" jaw crusher, then separated by a vibrating grizzly with the oversize passing through a 7' standard cone crusher. The recombined ore from the grizzly undersize and the standard crusher plus the short head crusher product was separated by two 8x20 screens with the oversize reporting to two 7' shorthead crushers and the undersize fed into the fine ore storage stockpile.

Equipment:

1 - Stephens-Adamson steel pan feeder. 60" widex34' centers. Capacity 300 tons per hour minimum to 1200 tons per hour. Automatic farval lube system. Variable speed drive Falk Sunstrand hydrostatic drive system model 25 PU displacement pump, C-FPG608 power unit and MH-187-G4-LSHT hydraulic motor rated 48hp.

1 - Allis Chalmers model 4860-A-1 jaw crusher 48'x60' single swing double toggle type. s/n B54901 with 200 hp 460/3/60, 1800 rpm motor.

1 - Simplicity model 1216AX single deck, 4 bearing scalping screen 6x16. Automatic lube system with a 40hp 460/3/6, 1800 rpm drive. s/n 1616-1216 AX-134.

2 - Simplicity model 1216AX double deck, 4 bearing, vibrating screen. Automatic lube system with a 50hp, 460/3/60, 1800 rpm motor. s/n 2820-1216AX-135 & 136.

1 - Symons 7' heavy duty standard cone crusher, coarse bowl, all steel construction, equipped with duckworth wedge type bowl clamping system, automatic lubrication and oil cooling system with 300hp, 4000/3/6, 705 rpm drive s/n 7762.

2 - Symons 7' heavy duty short head cone crushers, fine bowl, all steel construction, equipped with duckworth wedge type bowl clamping system, automatic lubrication and oil cooling system with 300hp, 4000/3/60, 705 rpm motor. s/n 7763 and 7764.

1 - Conveyor 48" wide by 36' long, horizontal, fabric belting, 35° troughing idlers. Designed to handle 100 tons per hour with 5hp, 460/3/60, 1800 rpm motor and 1215J24 Falk shaft mounted reducer.

1 - Conveyor 48" wide by 243' long, 49' of lift, fabric belting, 35° troughing and impact idlers. Designed to handle 1220 tons per hour with 4000/3/60, 1800 rpm wound rotor motor and Falk 2110Y2 parallel shaft reducer.

1 - Conveyor 48" wide by 452' long, 86' of lift, fabric belting, 35° troughing and impact idlers, designed to handle 2000 tons per hour with 250hp, 4000/3/60, 1800 rpm wound rotor motor and Falk 2150Y2 parallel shaft reducer.

1 - Conveyor 36" wide by 404' long, 54' of lift, fabric belting, 35° troughing and impact idlers. Designed to handle 780 tons per hour with 100hp, 4000/3/60, 1800 rpm wound rotor motor and Falk 2110Y2 parallel shaft reducer.

1 - Conveyor 36" by 555' long, 112' of lift, fabric belting, 35° troughing and impact idlers, designed to handle 1220 tons per hour, with 200hp, 4000/3/60, 1800 rpm wound motor and Falk 2130Y2 parallel shaft reducer.

1 - Ducon size 66, type UW-4, model III Dynamic scrubber, complete with structural support system, exhaust stack and 40hp, 1800 rpm drive.

1 - Ducon size 120, type US-4, model III Dynamic scrubber, complete with structural support system, exhaust stack, and 150hp, 1200 rpm drive.

1 - Ducon size 144, type UW-4, model III Dynamic scrubber, complete with structural support system, exhaust stack and 250hp, 1200 rpm drive.

1 - Ducon size 102, type UW-4, model III Dynamic scrubber, complete with structural support system, exhaust stack and 100hp, 1200 rpm motor.

1 - Dings No. 5 high intensity, oil cooled, stationary overhead magnet 48" wide x 54" long, with model 85612N 7.5KW Silicon rectifier.

1 - Dings No. 4 high intensity, oil cooled, stationary overhead magnet 48" wide x 52" long, with model 85611N, 5.0KW Silicon rectifier.

1 - Tectron model 4500A Tramp metal detector for 36" wide conveyor s/n 269.

1 - Tectron model 8000 Tramp metal detector for a 48" wide conveyor s/n B309.

1 - Ramsey Vey-R-Weigh conveyor scale system complete with Totalizer, load call, weigh bridge for a 48" conveyor.

1 - Kranco overhead traveling bridge crane. 20 ton capacity, pendant operated. 49' available lift, span 30'0". s/n 6900 type TRC D.

1 - Kranco overhead Traveling bridge crane. 20 Ton capacity, pendant operated. 56' available lift. Span 43'0". s/n 6899 Type TRE D.

2 - Ash 4x3 horizontal slurry pump frame A-135, with 5hp, 460/3/60, 1800 rpm motor.

2 - Ash 6x4 horizontal slurry pump frame B-6-5 rubber lined, with 15hp, 460/3/60, 1800 rpm motor.

2 - Ash 4x3 horizontal slurry pump frame A-135, rubber lined with 7.5hp, 460/3/60, 1800 rpm motor.

II. Grinding, Leaching and Thickening

Oxide ore is reclaimed by belt feeders from fine ore storage and milled in two parallel trains consisting of an 11.5x18' rod mill feeding a 12.5x30' ball mill in an open circuit wet grinding. The ball mill discharge is pumped to an overflow leach tank circuit where the ore is leached with concentrated H_2SO_4 acid. The slurry is then pumped to a train of four thickener countercurrent decantation for liquid solid separation. The pregnant solution is sent through two clarifiers and to the SX plant and the thickened solids are pumped to tails. The plant was designed to mill 10,000 DST per day.

Equipment:

4 - Reclaim conveyors, 48" fabric belting on a slide frame, 34.5' length shaft centers with a Falk Sunstrand variable speed hydrostatic drive system with model A-FPG power unit and model MH 373 LSHT hydraulic motor.

6 - Reclaim conveyors, 48" fabric belts on a slide frame. Length 34.5' shaft center with a Falk 102-120F2 speed reducer and 10hp, 460/3/60, 1800 rpm motor.

6 - Reclaim conveyor, 48" fabric belts on a slide frame. Length 34/5' shaft center with a Falk 102-120F2 speed reducer and 10hp, 460/3/60, 1800 rpm motor.

2 - Rod Mill Feed conveyors, 36" wide by 305' long fabric belting, 35° troughing idler with a Falk 2415J25 shaft mounted reducer and 20hp, 460/3/60, 1800 rpm motor. Ramsey Vey-R-Weigh model 40-15AS scale.

2 - Marcy Rod mill 11.5' diameter by 18' long O'flow type mill with scoop feeder. Shell is 2" thick. Falk gear helical, 229 Teeth, 20" face, 1.25 D.P. Pinion helical, 19 teeth, 20" face, 1.25 D.P.. Motor 1250hp, 4000/3/60, 720 rpm. Falk 116OYFN1 speed reducer. s/n 2998 & 2999.

2 - Marcy Ball mill 12.5' diameter by 30' long O'flow type mill with drum scoop feeder. Shell is 2" thick. Mill is metal lined. Falk gear helical, 236 teeth, 27" face, 1.007 D.P. Pinion helical 23 teeth, 27" face, 1.007 D.P.. Motor 3000hp, 4000/3/60, 720 rpm Falk 1195YFN1 speed reducer. s/ns 3001 & 3002.

1 - Falk inching device consisting of a Falk 211OYB4-A speed reducer with 20 hp, 460/3/60, 1800 rpm motor. Output shaft to mate with both oxide rod and ball mill speed reducers.

2 - ASH, 8"x6" frame BC-6-5, rubber lined, horizontal slurry pump with 60hp, 460/3/60, 1800 rpm motor.

2 - ASH, 8"x6" frame BC-6-5, rubber lined, horizontal slurry pump with Borg Warner model 265 variable speed drive with 60hp, 460/3/60, 1800 rpm flanged motor.

2 - ASH, 8"x8" frame C-6-5 rubber lined, horizontal slurry pumps with 25hp, 460/3/60, 1800 rpm motor.

3 - ASH, 10"x8", frame C-6-5, rubber lined, horizontal slurry pumps with 316 SS shaft sleeves and stuffing boxes. 75hp, 460/3/60, 1800 rpm motors.

1 - ASH 8"x8", frame C-6-5, rubber lined, horizontal slurry pump with 316SS shaft sleeve and staffing box. 100hp, 460/3/60, 1800 rpm motor.

1 - ASH 8"x8", frame C-6-5, rubber lined, horizontal slurry pump with 316SS shaft sleeve and stuffing box. Borg Warner model 465 H variable speed drive with Flange mounted 100hp, 460/3/60, 1800 rpm motor.

6 - ASH, 10"x10", frame CD-6-5, rubber lined, horizontal slurry pumps with 316 SS shaft sleeves and stuffing boxes. Borg Warner model 465 H variable speed drives with Flange mounted 100hp, 460/3/60, 1800 rpm motors.

2 - ASH, 10"x10", frame CD-6-5, rubber lined, horizontal slurry pumps with 316 SS shafts sleeves and stuffing boxes. Borg Warner model 465 H variable speed drives with Flange mounted 125hp, 460/3/60, 1800 rpm motors.

6 - Hazleton, 12" FN type US 8' long vertical pumps. All wetted parts 316 SS with 100hp, 460/3/60, 1800 rpm motors.

2 - Hazleton, 12" FN, type VS, 8' long vertical pumps. All wetted parts 316 SS with 125hp, 460/3/60, 1800 rpm motors.

2 - Portable rod chargers, complete with motors, drives and electrical controls.

1 - Kranco bridge crane with enclosed cab. Type TRE-BG, capacity 20 tons, span - 90'0", 55' available lift. s/n 6901.

8 - Leach tanks, 30' diameter by 30' high, rubber lined. Mild steel construction.

8 - Leach tank agitators complete with Denver #18 gear reducers, rubber covered 8' diameter. 6 bladed impellor and rubber covered, 19' shaft, with 75hp, 460/3/60, 1200 rpm motor.

5 - Dorr-Oliver thickeners, type 216 S-2 mechanism, 400' diameter, 25'6" depth at centerwell. All wetted parts 316SS. Two long rake arms and 2 stub arms.

1 - Dorr-Oliver thickener, type 122-S2 mechanism, 400' diameter, 28'7" depth at center well, all wetted parts 316SS. Two long rake arms and 2 stub arms.

1 - Denver model 50" XHH automatic sampler with timer, cast iron sample cutter.

1 - Denver model 50" XHH automatic sampler with timer, 316SS wetted parts.

1 - Denver wet slurry continuous vezin sampler, complete and self contained with cast iron cutter.

1 - Denver wet slurry continuous vezin sampler, complete and self contained with 316SS wetted parts.

5 - Wright 5 ton speedway hoist with 21' of lift at 15 FPM single speed with motorized trolley set to operate on circular track.

5 - Wright 5 ton speedway hoists with 49' lift at 21 FPM single speed - operate with plain trolleys.

III. Copper Solvent Extraction and Electrowinning

Copper Solvent Extraction

The copper bearing solution is split into two streams of 3000 to 3300 gpm each for counter current copper extraction in two parallel trains of mixer settlers. Each train consists of four extraction and two stripping stages.

Mixer settlers are of a standard Davey Powergas gravity design. A square mixing box 15'x15' contains a draft tube through which the phases are introduced into the eye of the turbine. The dispersion exits the top of the tank through a hole around the turbine shaft which prevents air entrainment from the dispersion air interface.

All wetted parts of the mixer settlers are 316 stainless steel construction.

Equipment:

8 each - Settler tanks, 45ft wide by 110ft long. Picket fences at both ends, all wetted parts 316SS.

4 each - Settler tank 45ft wide by 140ft long. Picket fences at both ends, all wetted parts 316SS.

12 each - Chemineer model 9-HTDA-100 high torque pump mixer with 100 H.P. 3 phase, 460 volt, 1775 RPM motor. 8' diameter enclosed impellor all shaft and impeller 316SS.

1 each - Loaded organic storage and surge tank 120,000 gal capacity, all 316SS construction.

1 each - Loaded organic storage and surge tank 100,000 gal capacity, all 316SS construction.

1 each - Diluent storage tank 58,000 gal capacity, mild steel const.

2 each - Worthington model 10FRB-182 horizontal centrifugal pump, all wetted parts 316SS, with 50 H.P., 3 phase, 460 volt, 1780 RPM motor.

2 each - Barret-Haentjen vertical pump model 10DN with 11'-0" shaft. 316SS construction with 200 H.P. 3 phase 460 volt 1780 RPM motor.

1 each - Barret-Haentjen vertical pump model 10DN with 11'-0" shaft all wetted parts 316SS, with 200 H.P. 3 phase 460 volt, 1200 RPM motor.

1 each - Barret-Haentjen vertical pump model 10DN with 11'-0" shaft, all wetted parts 316SS, with 200 H.P. 3 PH 460 volt, 1200 RPM motor and Borg-Warner variable speed drive model 687V.

2 each - Barret-Haentjen vertical pump model 5BN with 11'-0" shaft, all wetted parts 316SS, with 15 H.P. 3 phase 460 volt, 1780 RPM motor.

1 each - Delaval centrifuge type BRPX 207SGV-19-60/4183-24. Worm wheel shaft 1700 to 1800 RPM. All wetted parts 316SS with 10 H.P. 3 phase, 460 volt 1750 RPM motor frame 215T.

Electrowinning

The tank house consists of 216 concrete cells lined with PVC paraliners. Each cell contains 51 cathode and 52 anodes on 4" centers. The anodes are a cast lead calcium alloy. Starter sheets are prepared on titanium blanks. The cathodes are approximately 3'x4'. There are three recirculation systems in the tank house all fed from the common reservoir. Each recirculation system contains eight sections of nine cells each, and each has a transformer/rectifier for a nominal capacity of 120 tons per day.

The tank house is 100 ft. wide by 400ft. long. Steel construction with 316SS corrugated sheeting on walls and roof. Both cranes are on the same rails and cover the entire tank house cells and sheet preparation area. All piping is either PVC lined mild steel, 316 stainless steel, or polythene.

Equipment:

1 each - Electrolyte feed reservoir 210,000 gallon capacity, PVC lined concrete construction.

2 each - Barret-Haentjen vertical pumps model 10DN with 7'3" shaft. All wetted parts 316SS. 100 H.P. motor. 3 phase 460 volt, 1780 RPM TEFC, frame 405T.

1 each - Barret-Haentjen vertical pump, model 10D with 11'0" shaft. All wetted parts 316SS. 100 H.P. motor 3 phase, 460 volt, 1780 RPM. TEFC, frame 405T.

3 each - Barret-Haentjen vertical pump, model 8CN with 7'3" shaft. All wetted parts 316SS. 50 H.P. motor, 3 phase 460 volt, 1780 RPM TEFC, frame 326T.

3 each - Barret-Haentjen vertical pump, model 5BN with 7'10" shaft. All wetted parts 316SS. 100 H.P. motor, 3 phase 460 volts, 1780 RPM TEFC.

1 each - General Electric transformer/rectifier rated input 3 phase, 416 KV 60 HZ. Rated output 25 to 170 volt, 25000 AMP maximum current.

2 each - General Electric transformer/rectifier rated input 3 phase, 416 KV, 60 HZ. Rated output 90 to 170 volt, 25000 maximum current.

2 each - P&H overhead traveling bridge crane, enclosed cab, stiff leg type, 11 ton capacity - 101 ft. 10 in. span.

5 each - Cathode and starting sheet bales with 17 pairs of hooks.

1 each - General Conveyor cathode unloader. Hydraulic operated. Quadrant type.

1 each - Interlakes semi-automatic starting sheet preparation machine with bolster loading system, embossing rolls, sheet accumulator.

1 each - Interlake 48" slitter to trim ends and cut sheet to 28" width.

1 each - Interlake loop slitter to cut 4" strips for loops.

30 each - Starter sheet storage bolsters, 153 sheet capacity.

3 each - Cathode wash tanks 316SS construction.

1 each - Maren manually operated hydraulic vertical scrap baler. Model 2048 complete with hydraulic power pack with 5 H.P. 3 phase 460 volt motor.

1 each - Toledo platform scale model 2151, 9280 lb capacity, with electronic printer.

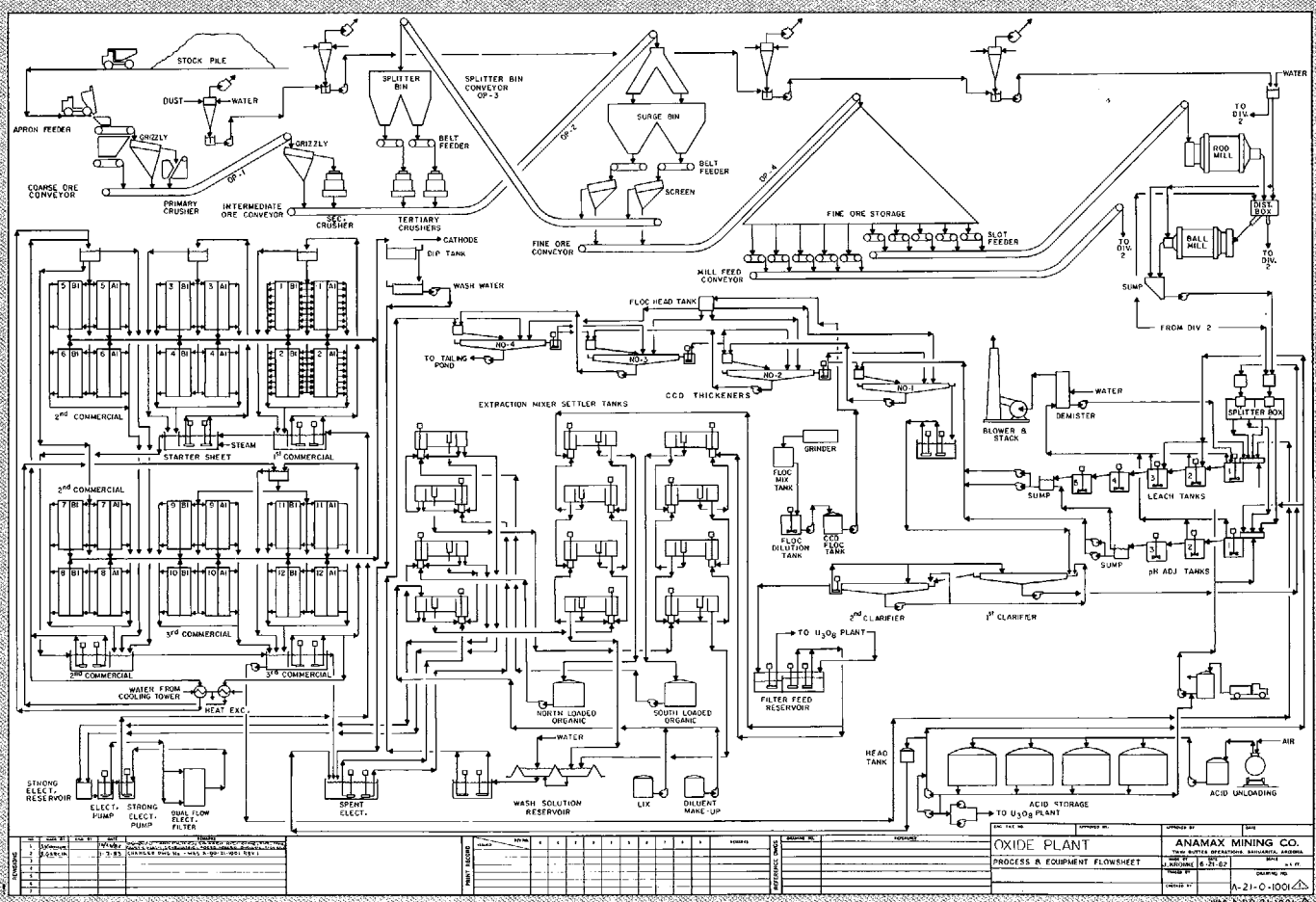
2 each - Tranter "Supercharge" model S-8-HP-125 plate and frame heat exchangers. 125 plates each 316SS construction. 2 pass arrangement.

3 each - Pearless vertical pumps size 10x10x16½ with 75 H.P. 3 phase 230/460 volt motor frame 365T P16 1775 RPM.

1 each - Worthington custom V horizontal pump size 6x5x17 with 75 H.P. 3 phase 460 volt, 1775 RPM motor frame 365T.

1 each - CE Natco filtration system size 10' dualflow including pipe and accessories for operation and blowdown. Vessel is 120" diameter by 12'6" high all wetted parts 316SS construction including piping and valving.

1 each - Strong electrolyte reservoir 172,000 gallon capacity. PVC lined concrete construction.



Oxide Plant Flowsheet

PARK CORPORATION
P.O. BOX 1488
MINE EQUIPMENT DIVISION
GREEN VALLEY, ARIZONA 85622
(602) 648-1630

SULFIDE CONCENTRATOR PLANT

Anamax Twin Buttes Mine
Green Valley, Arizona

This 44,000 DST per day sulfide plant was completed in December of 1969 and processed ore through July of 1983.

It consists of three facilities:

I. Concentrator (Mills, Flotation, Thickeners)
II. Molybdenum Plant
III. Filtration

These will be outlined separately in detail.

PARK CORPORATION
MINE EQUIPMENT DIVISION
P.O. BOX 1488 GREEN VALLEY, ARIZONA 85622 (602) 648-1630

I. Concentrator

This 44,000 ton per day concentrator consists of four milling divisions, each of which draw their rod mill feed from beneath the fine ore storage bin.

Each division consists of a rod mill and two ball mills, two cyclone feed pumps and four Krebs D-26 cyclones.

Flotation consists of 14 rows of rougher cells, three regrind mills, three sets of nine Krebs D15B cyclones and six rows of cleaner and scavenger cells. There are three 120' rougher concentrate thickeners.

The concentrator sends its tails to two 400' thickeners which each have eight D26B cyclones. The concentrator is fed to the molybdenum plant to remove moly and then goes to the filter plant.

Equipment:

12 - Belt feeders, 52" wide x 55' long. Belt changeout 110' plus splice. Drive is 15hp, 3 phase, 460 volt, 900 rpm motor with Louis Allis adjusto-speed eddy current clutch drive, frame # 364D 910. Speed reducer Western gear frame size 8312, ratio 210.1 to 1.

6 - Belt feeders 48" wide x 55' long. Fabric belt change out 124' plus splice. Drive is 15hp, 3 phase 460 volt, 1800 rpm Louis Allis Adjuste-speed model 9053. Speed reducer is Falk 2110Y3-C, ratio 291.2 to 1.

2 - Belt conveyor 36" wide x 52' long fabric belt change out 111' plus splice. Drive is 7.5hp, 3 phase, 460 volt RPM motor with Falk 7EZ3-06AG reducer.

3 - Belt conveyors, 36" wide x 253' long, fabric belt changeout 532' plus splice. 10hp, 3 phase, 460 volt, 1750 rpm motor with speed reducer Western 108M52. Scale Ramsey model 10-11 Vey-R-Weigh.

6 - Belt conveyors, 24" wide x 122' long fabric belt changeout 252' plus splice. 1½hp, 3 phase, 460 volt, 1760 rpm motor with Western 1.5 BM33 speed reducer. Scale Merrick model F.

1 - Belt conveyor, 36" wide x 211' long. Fabric belt changeout 457' plus splice. Drive 20hp, 3 phase, 460 volt, 1760 rpm motor. Falk model 2315T25 reducer.

1 - Belt conveyor, 18" wide x 115' long, fabric belt 236' changeout. 2hp, 3 phase, 460 volt, 1730 rpm motor with straight line model 1.5 BM 3339 reducer. Ramsey model 40-15 belt scale and totalizer.

1 - Belt conveyor, 18" wide x 88' long, fabric belt 180' changeout 1½hp, 3 phase, 460 volt, 1730 rpm motor with straight line model 1.5 BM 3339.

24 - Eriez model 110AH1-V1 vibrator feeder, suspension mounting, 36" wide x 96" long. Feed rate 20 to 35 TPH. Solid State AC operated SCR control.

6 - Allis Chalmers ball mills, 14.5' diameter x 28' long. O'flow type with scoop feeder. Rubber lined heads and shell. Shell 2" thick A181 1020 steel. Central lubrication system. Ring gear 321T, 1.25 D.P., 31" face split single helical 6°-30' angle cast steel, pinions 23T, 1.25 D.P., 31" face, single helical 6°-30' angle with 3,000hp, 3 phase, 4000 volt, 720 rpm synchronous motors. Falk 1180 FN1 single reducer. s/ns A94521, A94518, A91522, A94520, A94523 and A94519.

3 - Allis Chalmers Rod mills 14' diameter x 18.5' long O'flow type with drum-scoop feeder. Shell 1 piece 1¼" thick A131 1020 steel. Trunnion bearings 64" diameter x 34" long bronze bushed. Ring gear 323T-32" face 1.2" DP single helical 6°-30' angle cast steel split. Pinion 22T, 32" face 1.2" D.P. single helical 6°-30' angle. Central lube system with 2000 hp, 4000 volt, 720 rpm synchronous motor and Falk 1180YF1 single reduction reducer. 720/155. s/ns A 94517, A 94516, B 00479.

2 - Marcy Ball mills, 14.6' diameter x 23.5' long O'flow type mill with combination drum scoop feeder. Shell 2 pieces 2" thick A283C steel. Trunnion bearings 65"x26" bronze bushed. Ring gear 236T, face 27", 1.0070 D.P. single helical split, reversible. Pinion 22T face 27", 1.0070 D.P. single helical. Central lube system with 3000HP, 3 phase, 4000 volt, 720 rpm synchronous motor. Falk 1191YRN1 single reduction 4.563 ratio reducer. s/ns 2895 and 2896.

1 - Marcy Rod mill, 14' diameter by 18.5' long O'flow type mill with combination drum scoop feeder. Shell 2" thick A283B steel. Trunnion bearings 65"x26" bronze bushed. Ring gear 259T, face 32", 1.25 D.P. single helical, split, reversible. Pinion 25T, face 32", 1.25 D.P. single helical. 2000hp, 3 phase, 4000 volt, 720 rpm synchronous motor. Falk 30.8x30.62 21S single reduction 4.7037 reducer. s/n 2894.

9 - Warman series A 12"x14" slurry pump. All wetted parts rubber lined, with 200hp, 3 phase, 460 volt, 1175 rpm motor.

1 - Krebs D26B cyclones with high pressure gum rubber liners, victaulic grooved inlet and O'flow connections.

9 - Krebs D15B cyclones with high pressure gum rubber liners, victaulic grooved inlet and O'flow connections.

32 - Denver model 300 DR flotation machine with 30hp, 3 phase, 460 volt, 1150 rpm motors. Each machine consists of a single spindle and 300 cu ft nominal volume.

18 - Gallgher 12 cell flotation machines. Each cell consists of a single Gallgher 120 agitair spindle with a 20hp, 3 phase, 460 volt, 1200 RPM motor for each 2 cells.

18 - Gallgher 16 cell flotation machines. Each cell consists of a single Gallgher 120 agitair spindle with a 20hp, 3 phase, 460 volt, 1200 rpm motor for each 2 cells.

18 - Gallgher 20 cell flotation machines. Each cell consists of a single Gallgher 120 agitair spindle with a 20hp, 3 phase, 460 volt, 1200 rpm motor for each 2 cells.

4 - Westinghouse #2169-1 heavy duty pressure blower single stage SWS1 arrangement. Capacity 40,000 CFM @ 2.26 PSIG with 600hp, 3 phase, 4000 volt, 1500 RPM motor.

2 - Bayley type H, size 80 fans arrangement #5, with 75hp, 460/3/60, 1750 RPM motor.

3 - Marcy Reginald mills 7.5' diameter x 23' long O'flow type ball mill with combination drum scoop feeder shell 1" thick ASTMA-283-C steel Ring gear 307T, 14" face, 2.4 DP, 5° helix angle. Pinion 21T, 14" face 2.4 D.P., 5° helix angle. Trunnion bearings 32" diameter x 19" long bronze bushed. Drive is 500hp, 720rpm, 4000/3/60 synchronous motor with Falk single reduction reducer 4.13:1.

2 - Elmco thickeners, 120' diameter, 14' center depth, sloped bottom with 8.1" side wall height. Elmco type EX extra duty mechanism with 2 long rake arms, 2 stub arms, steel construction.

2 - Elmco thickeners, 100' diameter, 12' center depth, sloped bottom 6' side wall height. Elmco type CX heavy duty mechanism, 2 long rake and 2 stub arms, steel construction.

1 - P&H overhead 15/5 ton capacity, box girder type cab controlled traveling crane. Span 90'-6½", lift main and aux. hoist 50', s/n CHL 22323.

1 - P&H overhead 50/5 ton capacity, box girder type cab controlled traveling crane. Span 82'0", lift main and aux. hoist 62', s/n CL22322.

1 - P&H overhead 17 ton capacity, box girder type cab and radio controlled traveling crane. Span 82'0", lift 62', s/n CH24335.

1 - P&H overhead 5 ton capacity box girder type cab controlled traveling crane. Span 88'-7½", lift 57', s/n CHL 22326.

9 - ASH C-6-5 rubber lined slurry pumps 10"x8" with 30hp 3/460/60, 1780 rpm motors.

2 - ASH C12-5 rubber lined slurry pumps 14"x12" with 50hp 3/460/60, 1170 rpm motors.

3 - ASH C12-5 rubber lined slurry pumps 14"x12" with 100hp 3/460/60, 1770 rpm motors.

2 - Elmco thickeners, 100' diameter, 12' center depth, sloped bottom 6'2" side wall height. Elmco type CX heavy duty mechanism, 2 long rake arms, 2 stub arms, steel construction.

32 - Denver 300 DR machines with 30hp, 3 phase, 460 volt, 1180 rpm motors.

Arrangement of 1 left hand and 1 right hand bank of 16 cells each. Each cell consists of single spindle and 300 cu.ft. nominal area. Each bank arranged with feed box, 4 cells, junction box, 5 cells, junction box, 6 cells and discharge box.

864 - Gallagher 120 Agitar machines with one 20hp, 3 phase, 460 volt, 1200 RPM motor for each 2 cells. Each 2 cell area is 10'x10'x2' with 12 inches of weir bar.

There are 18 banks of cells with O'flow from both sides. Each bank is arranged with feed box, 12 cell area, divider, 16 cell area, divider, 20 cell area and discharge box.

II. Molybdenum Plant

The Molybdenum Plant was designed to process 1200 tons per day of CuMo concentrate and produce up to 20 tons per day of MoS_2. The circuit consists of two parallel trains of conditioning, rougher flotation and up to seven cleaner cells. Additionally, there is an insoluble flotation circuit, two thickeners, two spray dryers and a dry handling and packaging system.

III. Filtration

The Sulfide concentrate is stored and thickened in two 100' thickeners, then fed into three drum filters. These are installed outdoors and designed to operate 24 hours per day on an 85% availability. Maximum output was designed at 50 tons per hour with the feed slurry at 58% solids, 120°F temperature, 1.85 SG. The screen size is 325 mesh. Ph to be 7 plus.

The filter cake was 10% moisture by weight by the use of 80 PSI steam.

The plant includes concentrate handling and rail car loading systems. It was put into operation in 1976 and operated until 1983.

Equipment:

2 - ELMCO 100' diameter thickeners with 12' center depth, sloped bottom, 6'2" sidewall height. Designed at 600 STPD dry solids. Elmco type CX heavy duty mechanism.

1 - Agitated storage tank, size 24' high, 20' diameter. Capacity 200 tons of solid at 58% solids. Denver #15 gear box and agitator with 75hp 460/3/60, 120 rpm drive.

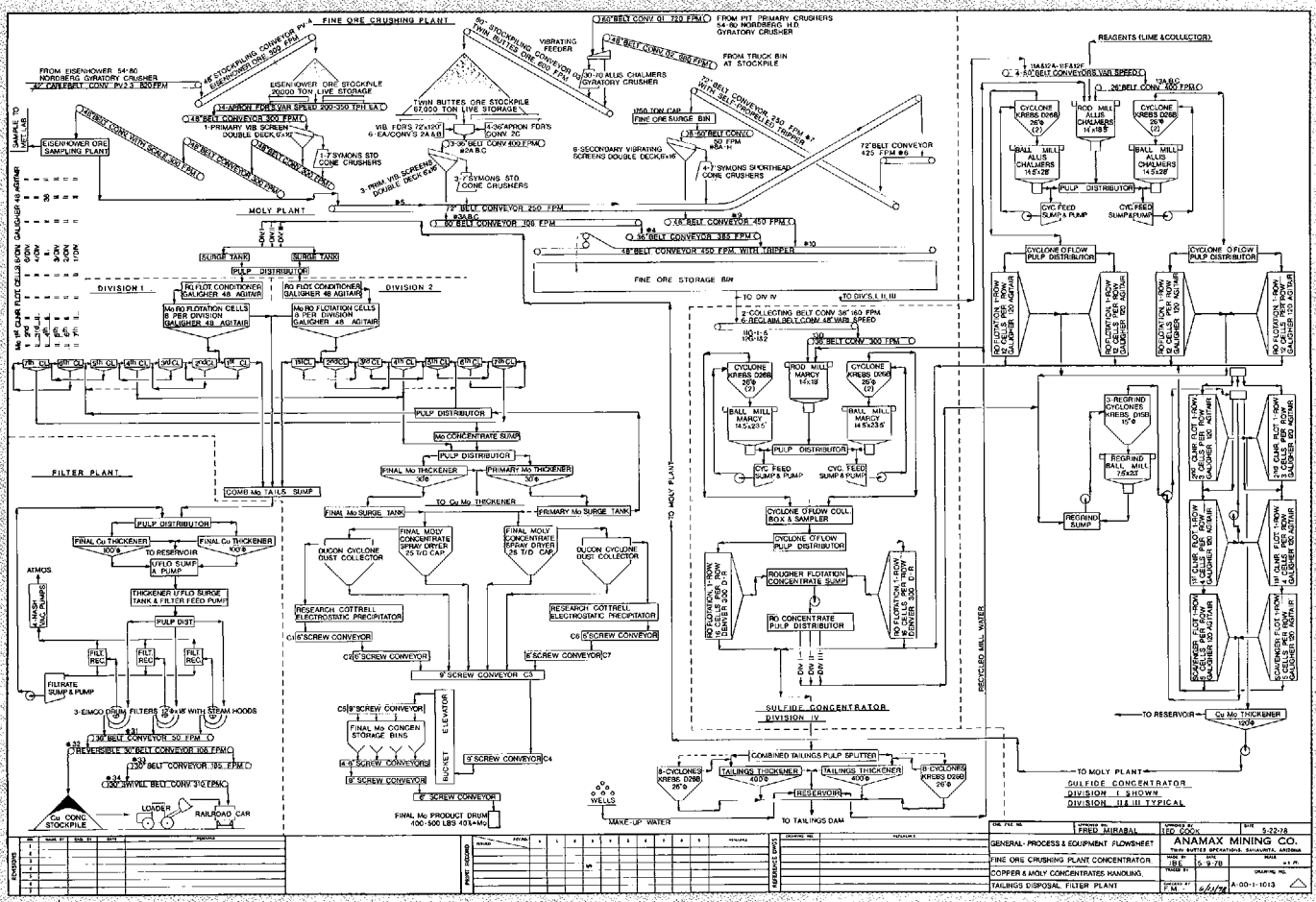
2 - Wilfley 6x4 model K sand pump complete with 40hp, 460/3/60, 1800 rpm motors.

1 - Denver H.D. motorized pulp distributor, 4' diameter, 3 compartment type EA with ½hp motor.

3 - ELMCO rotary scraper drum filters, 12' diameter by 16' drum length, double valve, complete with tank, tank agitator, 316SS screen and Reeves varispeed motor drive, size 343, 5hp, 3/460/60, s/ns 81517-01-AR, 81517-01-BR, 81517-01-BR.

4 - Nash model 6003 vacuum pumps, cast iron construction, rotor speed 312 rpm, volume 4000 CFM at 23.5 in. of Hg, with 300hp 4000/3/60, 1200 induction motor, s/ns 76U3810, 7643809, 76U3808, 76U4048.
3 - Vacuum receivers, 72" diameter by 84" height, complete with flanged connection.
1 - Galigher model 2.5 SA300x48 rubber lined sump pump with 3hp 460/3/60, 1800 rpm motor.
1 - Roots model RASE60-710, rotary lobe-type blower, 632 CFM at 3500' elevation, 10 PSI discharge with 50hp, 460/3/60, 1800 rpm motor.
3 - Galigher model 3.5 SA2100x60 rubber lined sump pump with 40hp, 460/3/60, 1800rpm motor.
1 - Conveyor 36' wide by 103' long fabric belt, 35° idler with Falk type J shaft mounted size 1215-J14 speed reducer and 5hp 460/3/60, 1800rpm motor.
1 - Conveyor-Transfer shuttle 30" wide by 81' long, fabric belt, 20° idlers, Falk shaft mounted model 1215J24 speed reducer and 3hp 460/3/60, 1800rpm reversing motor.
1 - Conveyor-Loadout station 30" wide by 53' long, inclined 10°, Falk shaft mounted model 1215J14 speed reducer and 5hp, 460/3/60, 1800rpm motor.
1 - Conveyor-Sloughing carloader 30" wide with 20° idlers.
1 - Wright monorail hoist, 8 ton capacity, model L36G10 with Chester model 1312-8 hand geared trolley.
1 - Robbin & Mayer bridge crane, 10,000 pound capacity, 20' span, 54'2" lift.
1 - Ramsey model 10-20-1 belt scale including model 40-20 electronic totalizer.
1 - Howe Richardson model 31000 railcar scale 410,000 pound capacity s/n 6012219, with Toledo model 8132 readout and printer.

Sulfide Concentrator Plant Flowsheet



CRUSHERS

PARK CORPORATION
P.O. BOX 1488
MINE EQUIPMENT DIVISION
GREEN VALLEY, ARIZONA 85622
(602) 648-1630

Anamax Twin Buttes Mine
Green Valley, Arizona

East Primary Crusher

The following is a list of major components that are intergral to the operation of the East Primary Crusher.

1. **Crusher** - Nordberg size 54/80 gyratory crusher, s/n GY 485. The crusher is a top suspended model equipped with a complete lubrication system and oil cooling system. G.E. 500 H.P., 4000V motor, V-belt drive.
2. Apron Feeder - 84"x19'10" manganese steel. 100 H.P. Falk 75CB3-12A1 gear reducer and motor.
3. Miscellaneous - Electrical switchgear, controls, panels and other electrical apparatus.

North and South Primary Crushers

The following is a list of major components that are intergral to the operation of the North and South Primary Crushing facilities. These two units operate independently of each other and are located several hundred feet apart midway down in the Twin Buttes Pit. Since both units are identical, major components belonging to one facility are listed for convenience (although two of each item are on hand).

1. **Crusher**
   A) Nordberg size 54/80 gyratory crusher, s/ns 428 or 429. The crusher is hydroset equipped with a mainshaft position indicator, complete lubrication system with oil cooling system with make up water supplied from an outside source.
   The crusher drive motor is a General Electric, 600 hp, 700 rpm, 4000V unit connected to the countershaft via 17 ea E-390 drive belts.
2. Primary feeder to crusher
   A) Hewitt-Robbins 96"x264" style 2E-13 Elliptex grizzly vibrator feeder. The feeder is driven by a Toshiba 125 hp Frame 505 UZ - A.C. variable frequency motor connected to the Feeder via a Spicer driveline.
3. Secondary take away feeder
   A) Hewitt-Robbins 72"x192", style E-13 Elliptex vibrating feeder. The feeder is driven by a Toshiba 50 H.P., frame 404T - A.C. variable frequency motor connected to the feeder via a Spicer driveline.
4. Miscellaneous - Electrical switchgear, controls, panels and other electrical apparatus.

Secondary Crusher

The secondary crushing plant is located inside a 100' long x 40' wide x 60' high structural steel building. Immediately adjacent is a 60' long x 30' wide x 60' high surge bin that contained live ore storage. These two connected units are located on a partially covered two story concrete foundation which also houses live storage for the secondary feeders, lubrication, cooling systems and the secondary feeders themselves.

The following is a list of major components that are intregral to the secondary crushing plant.

1. **Crushers**: 2 ea Allis-Chalmers Superior size 30/70 gyratory crushers, s/ns A-92212 and A-92211. These two units are equipped with hydrosets, mainshaft position indicators, complete lubrication, oil cooling systems and positive displacement air systems for the floating ring areas. The crusher drive motors are Westinghouse 400 hp, 500 rpm, 4000 V motors direct coupled to the crushers via a Falk clutch type coupling.
2. Primary feeders: 2 ea Hewitt-Robbins 72" x 285", style 2E-13 Elliptex vibrating grizzly feeders. These two units are each driven by a 75 hp Toshiba 900 rpm variable frequency drive motor and Emerson control unit. These motors are coupled to the feeders via Spicer heavy duty drive lines.
3. Secondary feeders: 2 ea Simplicity 74" x 168" pan feeders. These two units are each driven by a 40 hp Allis Chalmers, 1750 rpm motor, V-belt connected to the feeder. These two feeders have independent lubrication and cooling systems located nearby.

4. Miscellaneous equipment:
   A. P&H bridge crane with a 50 ton capacity main hoist and 5 ton capacity aux. hoist.
   B. Otis 5,000 lb. capacity elevator that services all levels.
   C. Electrical room contains Westinghouse, Clark and Emerson panels for distributing 4160 V, 480 V, 220 V and 110 V service.
   D. Dust Collector: Wheelabrator screw type conveyor and baghouse type service all levels.

Palo Verde Crusher

The following is a list of major components that are integral to the Palo Verde crusher and take away feeder.

1) Nordberg size 54/80 gyratory crusher, s/n GY516. This unit is hydroset equipped with a mainshaft position indicator, complete lubrication system and oil cooling system with make up water supplied from an outside source. The crusher drive motor is a General Electric 500 hp, 705 rpm, 4,000 V unit is V-belt driven.

2) NICO 72" x 20' long heavy duty apron feeder. This unit is powered by a self-contained Falk fluid drive and enclosed gear box, model #60VCVF-GA242414.

3) Miscellaneous
   A) Self-contained hydraulically operated rock grapple.
   B) Electrical - Electrical switchgear, controls, panels and other electrical apparatus.

Portable Crushing Sample Plant

The sample plant consists of:

Pioneer Primary crushing plant manufactured by Missouri-Rogers, s/n 2584, complete with the following:
   a. Missouri-Rogers vibrating grizzly feeder
   b. Feeder dozer trap with wing walls
   c. Pioneer 20"x36" primary jaw crusher with new rebuilt plates
   d. Tandem walking beam axle assembly with total of (8) tires
   e. Product conveyor, approx 36"x25'
   f. King pin attachment
   g. 440 V electric starters for electric starters for electric power on vibrating feeder and delivery conveyor

Additional materials added to plant:

1. Rogers machine works jaw crusher, 24" length, 16" wide, 8" throat opening
2. Rotary sample splitter
3. 2 cutler hammers, size 4, FWR, 3 pole, 3 phase open type contractor with 120 V magnetic coil

Kaiser Steel's Eagle Mountain Iron Ore Mine Eagle Mountain, California

Symons 7' Cone Crushers

1-7' Shorthead extra heavy duty cone crusher sn 7458.
Fine bowl with medium cavity design liner, standard eccentric throw, water chamber type/grease sealed, hydraulic adjustment rams and cylinder lockposts, belt driven with external main frame pins, packaged lube system. Unit driven by a Westinghouse, 350hic frame 686.5-D, 4160V, 46amp, 1.15 service factor, 711 rpm style 1961014 motor, s/n 25-64.

1-7′ Standary heavy duty cone crusher s/n 7280.
Extra coarse bowl with medium cavity design liner, standard eccentric throw, air sealed, hydraulic adjustment rams and cylinder lockposts, belt driven with internal main frame pins. Package lube system. Unit driven by a Westinghouse 300hp, frame CS3A, 4160V, 38 amp, 1.15 service factor, 695 rpm motor, s/n 2-3B1081.

1-7′ Standard heavy duty cone crusher s/n 7399.
Extra coarse bowl with medium cavity design liner, standard eccentric throw, air sealed, hydraulic adjustment rams and cylinder lockposts, belt driven with internal main frame pins. Package lube system. Unit driven by a Westinghouse 300hp, frame CS3A, 4160V, 38 amp, 1.15 service factor, 695 rpm motor, s/n 63V1081.

1-7′ Short head heavy duty cone crusher s/n 7279.
Coarse bowl with medium cavity design liner, standard eccentric throw, air sealed, hydraulic adjustment rams and cylinder lockposts, belt driven with internal main frame pins. Package lube system. Unit driven by a Westinghouse 300hp frame C53A, 4160V, 38 amp, 1.15 service factor, 702 rpm motor, s/n 1674P667.

1-7′ Short head heavy duty cone crusher s/n 7401.
Coarse bowl with medium cavity design liner, standard eccentric throw, air sealed, hydraulic adjustment rams and cylinder lockposts, belt driven with internal main frame pins. Package lube system. Unit driven by a Westinghouse 300hp frame C53A, 4160V, 38 amp, 1.15 service factor, 695 rpm motor, s/n 53V1081.

1-7′ Short head heavy duty cone crusher s/n 7400.
Coarse bowl with medium cavity design liner, standard eccentric throw, air sealed, hydraulic adjustment rams and cylinder lockposts, belt driven with internal main frame pins. Package lube system. Unit driven by a Westinghouse 300hp frame C53A, 4160V, 38 amp, 1.15 service factor, 695 rpm motor, s/n 3-3V1081.

1-7′ Short head heavy duty cone crusher s/n 7402.
Coarse bowl with medium cavity design liner, standard eccentric throw, air sealed, hydraulic adjustment rams and cylinder lockposts, belt driven with internal main frame pins. Package lube system. Unit driven by a Westinghouse 300hp frame C53A, 4160V, 38 amp, 1.15 service factor, 695 rpm motor, s/n 4-3V-1081.

Anamax Twin Buttes Mine
Green Valley, Arizona
Symons 2′ Cone Crushers

1 - 2′ Symons standard cone crusher - s/n E-2514, coarse bowl with coarse cavity design liner, standard eccentric throw, standard seal, adjustment capscrew type bowl clamping system, duckworth-windlass bowl adjustment system, belt driven with internal main frame pins, package lube system. Unit is driven by a Westinghouse 30 hp mill and chemical type, 900 rpm, 460 V motor.

1 - 2′ Symons shorthead cone crusher - s/n E-2515, coarse bowl with fine cavity design liner, standard eccentric throw, standard seal, adjustment capscrew type bowl clamping system, duckworth-windlass bowl adjustment system, belt driven with internal main frame pins, package lube system. Unit is driven by a Westinghouse 30 hp mill and chemical type, 900 rpm, 460 V motor.

CONVEYORS

Anamax Twin Buttes Mine
Green Valley, Arizona

The following are descriptions of conveyor systems available either as complete units or on a piece by piece basis.

Cable Belt, Ltd. Conveyor System (42″ wide; 6.4 miles long)

The unique feature of this system is the separation of the driving (tension) medium from the material carrying medium. In conventional systems, the belt must be capable of performing both functions. Since wire ropes provide the driving tension, only tension sufficient to prevent folding need be applied to the belt itself.

Additional advantages over conventional conveyor systems include:

1. Single drive. One of the principal advantages of the cable belt system is that long belts can be driven from a single drive station, even when major changes in belt direction occur along the route. Only one drive is required for the Anamax system, which includes one 60° bend. Conventional systems would have required several drive stations, increasing system complexity and decreasing availability.

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P.O. BOX 1488 GREEN VALLEY, ARIZONA 85622 (602) 648-1630

2. Lower power consumption. The cable belt system, with its widely spaced pulleys, has approximately half the number of bearings of a conventional system. The belt is also lighter and is not continuously flexed by troughing idlers. All of these factors reduce system drag, and therefore the power to drive the system. Anamax estimates that the cable belt system uses 30% less power than a similar conventional system.
3. Maintenance simplicity. Having fewer components, the cable belt system requires less maintenance. The most maintenance-prone components, the rope support pulleys, are easily changed and repaired. The light belt is easier to install, and can be shipped in longer lengths, necessitating fewer splices.
4. Resistance to ripping. On a long conveyor system, long belt rips are a very real danger. Belting for the cable belt system is virtually rip-proof because of the transverse stiffeners and low tension belt splices.
5. Belt splices. Conventional high tension belting requires high tension splices. Even under ideal conditions, high tension splices take at least three shifts to repair because of the vulcanizing required. The cable belt low tension splices consist of opposing wire clips on the two sections of belt to be joined, which are held together by a short length of small diameter wire rope. Under good conditions, the belt can be spliced in an hour.
6. Ease of alignment. A high-tension belt with 40 to 50 splices and variable loads would be very difficult to keep aligned. Poor alignment leads to belt edge damage, tension cable deterioration and belt failure. The cable belt system does not require belt alignment since the belt is loosely attached to the wire ropes, which are kept in alignment by rope support pulleys.
7. Low spillage. Since the belt in the cable belt system does not pass over idlers, the material is carried smoothly with little tendency to spill off the belt or create dust, especially at transfer points.
8. Proven reliability. Although unfamiliar in the U.S., numerous cable belt systems are at work around the world, in contrast to several other prototype nonconventional systems.

General Description:

The conveyor is a 1.07 m (42 in) wide cable belt, 9910 m (32,513 ft) from head drum (pully) to tail drum. The system is designed to carry 1800 tonnes (2,000 short tons) of copper ore per hour at a speed of 251 m (824 ft) per minute. Two 41 cm (1.6 in) type 6x19 Long lay wire ropes in endless loops run the entire length of the conveyor. These ropes support the belt, and are driven by a single drive unit at the head end.

The belt is made of DuPont Nordel hydrocarbon rubber, which was selected because of its resistance to cracking and checking in the desert environment. The original belt is stiffened laterally by 0.5x1.3 cm (0.2x0.5 in) spring steel straps spaced approximately 8 cm (3 in) apart. The thickness and spacing of these straps determine the troughing of the belt under load; with no load, the belt is flat.

The belt on the short leg of the conveyor has been replaced with a "strapless" belt, which uses a mesh of steel wire and synthetic fibers molded into the Nordel.

Two continuous vee grooves are located near the edges of the belt on both top and bottom. The ropes ride in the bottom grooves on the ore carrying trip and in the top grooves on the return trip. The bottom grooves are located about 19 cm (7.5 in) in from the edges of the belt where they form a small "lip" which helps to prevent spillage.

Rope support pulleys - The rope support pulleys are 30 cm (12 in) in diameter and are lined with a polyurethane tread. These pulleys are designed for easy removal, repair and replacement. Two polyurethane-lined half rims are bolted to the cast-iron pulley hub containing ball bearings. When the tread is worn, half rims can be removed and replaced with new or relined half rims.

Rope support pulleys are placed in pairs on both sides of the belt at each linestand. In the Anamax system, linestands are spaced approximately 5 m (16.5 ft) apart. Pulley pairs are generally placed at every third linestand to support the return ropes.

Linestands - The linestands consist of welded rectangular frames which completely surround the belt. The linestands support cross arms which in turn support the pulleys. The cross arms can be adjusted to align the pulleys with the rope.

The linestands are bolted to cylindrical cast-in-place concrete foundations. These foundations are 46 cm (18 in) in diameter and extend a minimum of 1.1 m (3.5 ft) into the ground. The foundation tops are generally 15 to 46 cm (0.15 to 1.5 ft) above ground level. High linestand foundations are used on bridge approaches and at minor washes and defiles.

The conveyor cover is supported on purlins which run between linestands.

Angle station - One of the more ingenious features of the system is a 60° angle bend located some 827 m (2700 ft) from the loading point. Here, the driving ropes and material flow change direction. The belt itself consists of two separate sections which do not make the bend.

At the angle station, the incoming belt is lifted off the driving ropes by a series of small idlers which fit into the vee grooves. The belt then passes around a head pulley, spilling its load into a chute, and around a tension pulley. A third pulley directs the belt back toward the loading point. The belt is then lowered onto the return ropes. The outgoing belt picks up the material from the chute and carries it to the final discharge point some 9083 m (29,800 ft) distant.

Once the incoming belt has been lifted off the driving ropes, the ropes are directed away from the belt and around the bend by the large diameter pulleys. The ropes are then aligned with the vee grooves in the outgoing belt, and the belt is lowered onto them after it passes the loading chute. The return ropes are treated similarly, so that one pair of ropes drives both sections of belt.

Rope tension system - Near the head end of the conveyor, the driving ropes are tensioned by a system which ensures that both ropes receive the same tension in spite of differential stretch or differing rope lengths. Forty seven tonnes (52 tons) of steel supported in a tension tower 30m (100 ft) tall provide tension to two rope tension bogies. The rope tension bogies carry large diameter pulleys which transmit the tension to the driving ropes. These bogies travel on tracks 107 m (350 ft) long, one on either side of the conveyor, thereby allowing rope stretch to be taken up independently.

Drive unit - Two 1120 kw (1500 hp) electric motors are directly coupled to the triple reduction gear box, which drives the ropes through two Koepe friction wheels. The motors are of the wound rotor type, with a liquid rheostat unit for controlling conveyor speed during start-up. The starting cycle takes approximately seven minutes. The drive is designed so that a fully loaded conveyor can be started and unloaded with one motor, and can be operated at half capacity (900 tonnes (1000 tons) per hour) on one motor.

The system was in operation from January of 1979 through July 1983.

Cable Belt, Ltd. Conveyor Specifications:

Conveyor length	9910 m (32,513 ft)
Difference in elevation between terminals	15 m (50 ft)
*Rated design capacity	1814 tonnes/hr (2000 short tons/hr)
Conveyor belt loading at rated design capacity	121 kg/m (81 lb/ft)
Material	Copper ore
Material density	1762 kg/cu m (110 lb/cu ft)
Material lump size	-15 cm (-6 in)
Daily operating time	14 hours
Annual tonnage	4,536,000 tonnes (5,000,000 short tons)
Belt width	1.07 m (42 in)
Conveyor speed	251 m/min (825 ft/min)
Rope diameter	41 cm (1.6 in)
Rope specifications	British Ropes No. 431
Factor of safety of rope at rated design capacity	3.3:1
Rated motor power	2x1120 kw (2x1500 hp)
Drive unit Koepe wheel diameter	3 m (10 ft)
Rope tension pulley diameter	1.93 m (6.33 ft)
Approximate linestand spacing	5 m (16.5 ft)
Rope support pulley diameter	30.5 cm (12 in)

Rated design capacity is an average over the conveyor length, with the feed rates controlled to within plus or minus 10%.

Additional Conveyor Systems Available:

Stacking conveyor - The overland conveyor discharges through a bin onto a conventional 1.2 m (49 in) wide by 142 m (500 ft) long stacking conveyor at the Twin Buttes end. This conveyor places the ore on a 18,000 tonne (20,000 ton) live stockpile which allows surge capacity between the conveying system and the concentrating plant.

West Conveying System - Southside in Pit

1. P-1S Conveyor
   - A. Rubber - 1700' PIW steel cable belting, 60"
   - B. Length - 145', no lift
   - C. Drive Gearbox - Jones 14 SMDBH, 90 HP, 18,683 to 1 ratio
   - D. Drive Motor - 100 HP, 1800 RPM sq. cage motor 1 each
   - E. Idlers - H.R. 7" troughing idlers, 35° on 48" centers returns are H/R. 7" flat on 120" centers
   - F. P-1S is magnet equipped
2. P-2S Conveyor
   - A. Rubber - 1700 PIW steel cable belting, 60"
   - B. Length - 168', 22' lift
   - C. Drive Gearboxes - 2 ea Jones 14SMDBH, 90 HP, 1750 RPM
   - D. Drive Motors - 2 ea Westinghouse 125 HP, 1750 RPM
   - E. Holdback Capability - each gearbox is equipped with Formsprag high speed holdback
   - F. Idlers - H.R. 7" troughing idlers, 35° on 48" centers
   - G. P-2S is metal detector equipped

3. R-1S Conveyor
   A. Rubber - 3750 PIW steel cable belting, 60″
   B. Length - 2517′ with 607′ lift
   C. Drive Gearboxes - 4 ea Jones 72DP, 1116 HP 38.75 to 1 ratio
   D. Drive Motors - 4 ea Westinghouse 1250 HP 1750 RPM
   E. Holdback Capability - each gearbox equipped with Formspring high speed holdback
   F. Idlers - H.R. 7″ troughing idlers, 35° on 48″ centers
4. R-2S Conveyor
   A. Rubber - 1700 PIW steel cable belting, 60″
   B. Length - 1887 with 99′ lift
   C. Drive Gearbox - Jones 72DP, 38.75 to 1 ratio
   D. Drive Motor - Westinghouse 1250 HP, 1750 RPM
   E. Holdback Capability - gearbox is equipped with Formsprag high speed holdback.
   F. Idlers - H.R. 7″ troughing idlers, 35° on 48″ centers
   G. R-2S is load scale equipped

West Conveying System - Sulfide and Oxide Conveyors

1. O-1 Conveyor
   A. Rubber: 1700 PIW steel cable belting, 60″
   B. Length: 3907′ with 6′ lift
   C. Drive Gearboxes: 2 ea 400 HP, Jones 24D, 23.47 to 1 ratio
   D. Drive Motors: 2 ea 400 HP Westinghouse motors, 1750rpm
   E. Idlers: H.R. 7″ troughing rollers, 35° on 48″ centers, flat returns on 120″ centers
   F. O-1 conveyor is equipped with a B.F. Goodrich rip detection system.
2. SP-1 Conveyor
   A. Rubber: 1700 PIW steel cable belting, 60″
   B. Length: 1240′ with 12′ lift
   C. Drive Gearbox: 400hp Jones 24D with 23.47 to 1 ratio
   D. Drive Motor: 400hp Westinghouse, 1800 rpm
   E. Idlers: H.R. 7″, 35° troughing idlers, 35° on 48″ centers, returns on 120″ centers
   F. SP-1 conveyor is connected to a truck bin capable of loading 120T trucks

West Conveying System - Overburden System

1. W-1 Conveyor
   A. Rubber - 3750 PIW steel cable belting, 60″
   B. Length - 3,039′ with 190′ lift
   C. Drive Gearboxes - 2 ea Foote Jones 2 amps-405A, 1939hp, 25,56 to 1 ratio
   D. Drive Motors - 2 ea Westinghouse 1250hp, 1750rpm
   E. Holdback Capability - each gearbox is equipped with Formsprag highspeed holdback
   F. Idlers - H.R. 7″ troughing idlers, 35° on 48″ centers, flat returns on 120″ centers
2. W-2A Conveyor
   A. Rubber - 1700 PIW steel cable belting, 60″
   B. Length - 131′ with 11′ lift
   C. Drive Gearboxes - 2ea Jones 14 SMDBH, 90hp, 18.683 to 1 ratio
   D. Drive Motors - 2 ea Westinghouse 125 hp, 1750 rpm
   E. Holdback Capability - each gearbox is equipped with Formsprag high speed holdback
   F. Idlers - H.R. 7″ troughing idlers, 35° on 36″ centers, flat returns on 120″ centers
   G. W-2A is equipped with a truck bin for use with trucks when shifting W-3
3. W-2B Conveyor
   A. Rubber - 3750 PIW steel cable belting, 60″
   B. Length - 321′ with 9′ lift
   C. Drive Gearbox - Jones 22 SMDBH, 400hp, 18.05 to 1 ratio
   D. Drive Motor - Westinghouse, 400hp, 1750rpm
   E. Idlers - H.R. 7″ troughing idlers, 35°, on 36″ centers, flat returns on 120″ centers
4. W-3 Conveyor
   A. Rubber - 1700 PIW steel cable belting, 60″
   B. Length - 2425′ with 25′ lift
   C. Drive Gearbox - Jones 22SMDBH, 400hp, 18.05 to 1 ratio
   D. Drive Motor - Westinghouse 400hp, 1750rpm
   E. Idlers - H.R. 7″ troughing idlers, 35° on 48″ centers, flat returns on 120″ centers
   F. W-3 Conveyor is equipped with a traveling tripper and is also shiftable

5. W-4 Stacker
   Hewitt Robbin design with Manitowoc crawler model 3900-W base
   A. Rubber - 1700 PIW 60" steel cable belting, 60"
   B. Length - 200' with 36' lift
   C. Drive Gearbox - Jones 22SMDBH, 400hp, 18.05 to 1 ratio with a Formsprag high speed holdback
   D. Drive motor - Westinghouse, 400hp, 1750 rpm
   E. Idlers - H.R. 7" troughing and return idlers
   F. W-4 conveyor stacker is a self propelled crawler stacker capable of moving 31 FPM in either direction

West Conveying System - Northside in Pit

1. P-1N Conveyor
   A. Rubber - 800 PIW steel cable belting, 60"
   B. Length - 145", no lift
   C. Drive Gearbox - Jones 14 SMDBH, 90 HP, 18,683 to 1 ratio
   D. Drive Motor - 100 HP, 1800 RPM sq. cage motor
   E. Idlers - H.R. 7" troughing idlers, 35° on 48" centers returns are H.R. 7" flat on 120" centers
   F. P-1N is magnet equipped
2. P-2N Conveyor
   A. Rubber - 1700 PIW steel cable belting, 60"
   B. Length - 168' with 22' lift
   C. Drive Gearboxes - 2 ea Jones 14SMDBH, 90 HP, 18,683 to 1.
   D. Drive Motors - 2 ea Westinghouse, 125 HP, 1750 RPM
   E. Holdback Capability - each gearbox is equipped with: Formsprag high speed holdback
   F. Idlers - H.R. 7" troughing idlers, 35° on 48" centers
   G. P-2N is metal detector equipped
3. R-1N Conveyor
   A. Rubber - Goodyear 3750 PIW steel cable belting, 60"
   B. Length - 2517' with 60" lift
   C. Drive Gearboxes - 4 ea Jones 72DP, 1116 HP 38.75 to 1 ratio
   D. Drive Motors - 4 ea Westinghouse 1250 HP 1750 RPM
   E. Holdback Capability - each gearbox equipped with Formspring high speed holdback.
   F. Idlers - H.R. 7" troughing idlers, 35° on 48" centers
4. R-2N Conveyor
   A. Rubber - 1700 PIW steel cable belting, 60"
   B. Length - 1887' with 99' lift
   C. Drive Gearbox - Jones 72DP, 38.75 to 1 ratio
   D. Drive Motor - Westinghouse 1250 HP, 1750 RPM
   E. Holdback Capability - gearbox is equipped with Formsprag high speed holdback

East Conveying System

1. R-3 Conveyor
   A. Rubber - 1700 PIW steel cable belting, 60"
   B. Length - 793' with 196' lift
   C. Drive Gearboxes - 2 ea Falk 2185Y2-B-700 H.P. each - 31.07 to 1 ratio
   D. Drive Motors - 2 ea Westinghouse 700 H.P. sq. cage motor
   E. Soft start capability - equipped with American standard Gyrol size 231 on each drive motor
   F. Holdback Capability - 2 ea Marland one way clutch backstop model BC 135 MA
   G. Idlers - S.A. 7" diameter, 35° and 45° on 36" centers - returns are frame mounted 10° on 120" centers
   H. R-3 conveyor includes scale, magnet and metal detector
2. C Conveyor
   A. Rubber - Goodyear 3750 PIW steel cable belting, 60"
   B. Length - 2216' with 515' lift
   C. Drive Gearboxes - 4 ea Falk model 2215Y2S, 1257 H.P. 30.812 to 1 ratio
   D. Drive Motors - 4 ea General Electric 1250 H.P., frame 63545S; 4000V, 1775 RPM motors
   E. Holdback Capability - 4 ea Marland BC-60M backstops
   F. Idlers - S.A. 7" diameter, 45° on 48" centers, S.A., chaintype V-returns on 120" centers
   G. Conveyor has 4 ea 500 ton feed hoppers equipped with G.E. 40 H.P. motor, 1750 RPM, 72" x 14' apronfeeders; Falk gearbox, 8C302A4, 40 H.P. 38.45 to 1

3. D Conveyor
   A. Rubber - Goodyear 3750 PIW steel cable belting
   B. Length - 3935' with 415' lift
   C. Drive Gearboxes - 4 ea Falk model 2215Y25, 1257 H.P. 30.812 to 1 ratio
   D. Drive motors - 4 ea General Electric 1250 H.P. frame 63545S, 4000V, 1775 RPM motors
   E. Holdback Capability - 6 ea Marland BC-60M backstops
   F. Idlers - S.A. 7" diameter, 35° on 48" centers, S.A. chain type V-returns on 120" centers
   G. D Conveyor is equipped with a 1000 ton truck bin located midpoint for use with trucks while shifting "E" conveyor
   H. D Conveyor is equipped with tonnage scale

4. E - Conveyor
   A. Rubber - 1700 PIW steel cable belting, 60"
   B. Length - 3250' with 30 lift
   C. Drive Gearboxes - 3 ea Falk 2185Y2-B, 700 H.P. 31.07: 1 ratio
   D. Drive Motors - 3 ea Westinghouse 700 H.P. sq. cage motors
   E. Soft start capability - equipped with 3 ea American Standard Gypols, size 231
   F. Holdback Capability - 3 ea Marland one way clutch backstop model BC 135 M.A.
   G. Idlers - S.A. 7" diameter, 35° on 48 centers, returns are chain V type in 10' centers

5. F-Stacker 120" diesel powered - self propelled crawler
   A. Rubber - 1700 PIW steel cable belting, 60"
   B. Length - 215' with 30' Max rise
   C. Drive Engine - Detroit Diesel 16V71 with Allison torque converter
   D. Drive Gearbox - Falk 2150YB2, 851 H.P., 10.02: 1 ratio
   E. Holdback Capability - Marland high speed backstop
   F. Idlers - Rexnord and S.A. 7" diameter, 35° on 36" centers, S.A. 10° frame mounted V-returns on 10' centers

amax

MINING ENGINEERING

ANAMAX
MINING COMPANY
TWIN BUTTES OPERATION

TWIN BUTTES—A Deep Low-Grade Copper Producer

A. BLAKE CALDWELL
Managing Editor

AN OVERVIEW OF THE TWIN BUTTES OPEN PIT MINE OF THE ANAMAX MINING COMPANY

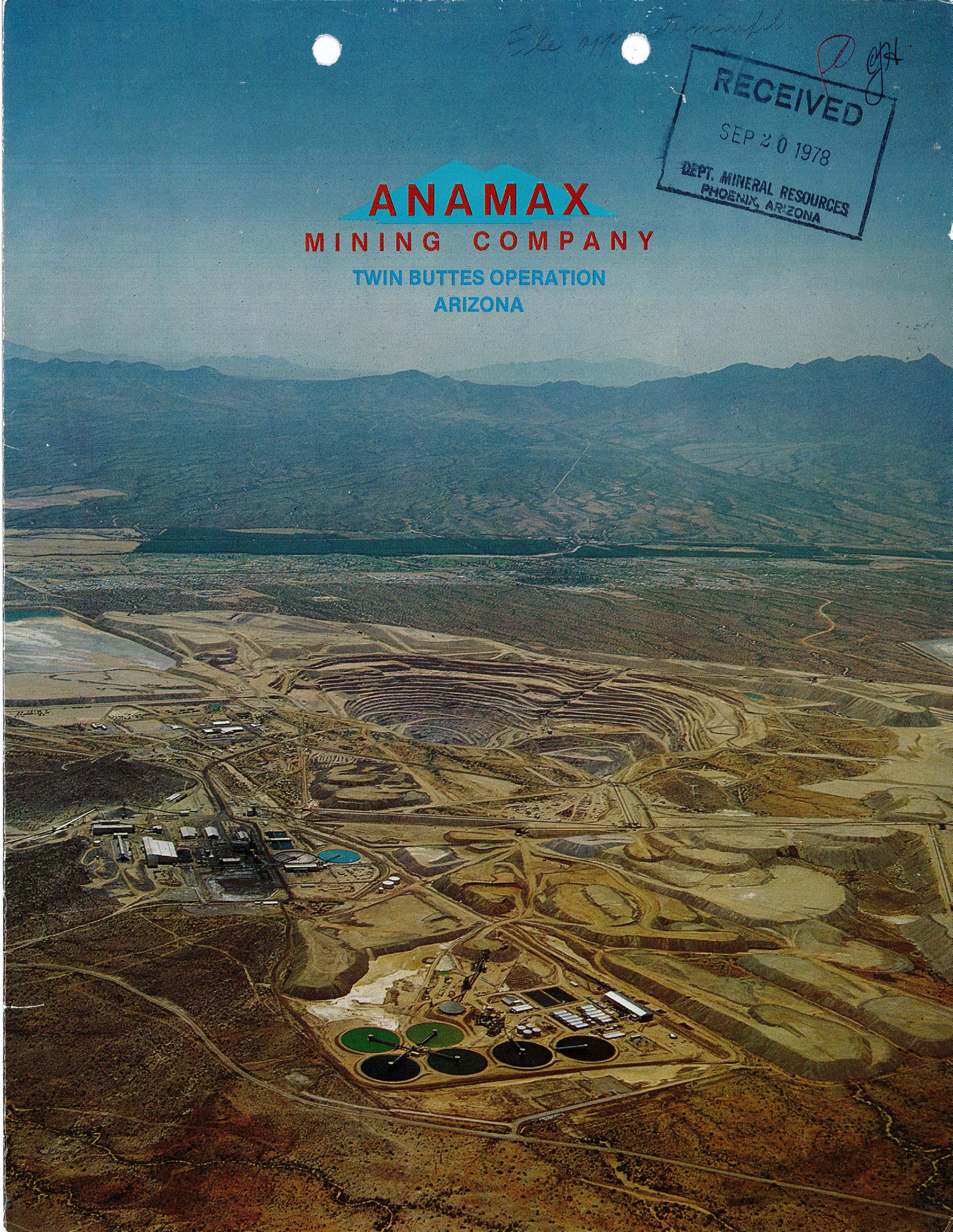
The Twin Buttes Mine is operated by the Anamax Mining Company. Anamax was formed in June of 1973 when the Anaconda Company and American Metals Climax, Inc. (AMAX) signed agreements that created a 50-50 partnership to operate and expand the Twin Buttes Mine.

The agreement included the acquisition by AMAX of the Banner Mining Company, from which Anaconda had leased the Twin Buttes property.

Revised Reprint from Mining Engineering, April 1970

ANAMAX
MINING COMPANY

TWIN BUTTES OPERATION
ARIZONA

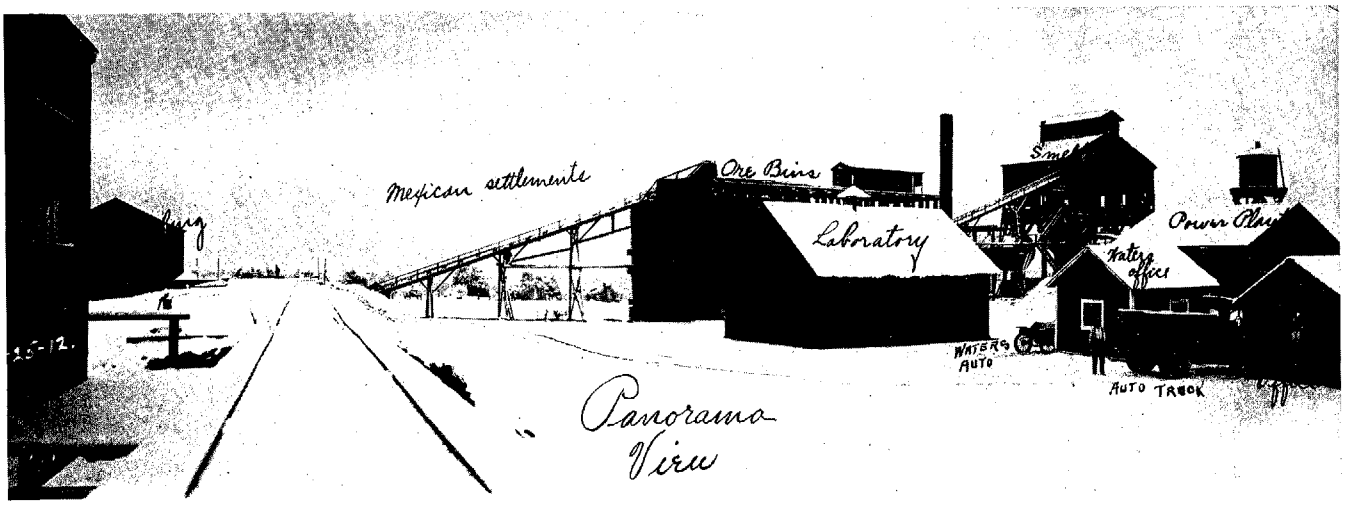


BEGINNINGS

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 1¾ miles long, 1¼ 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

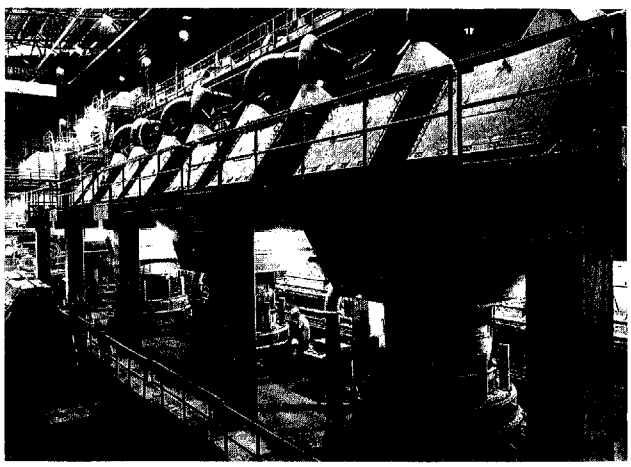
There are two distinct types of copper ore mined at Twin Buttes—oxide ore which is principally chrysocolla, and sulfide ore which is principally chalcopyrite.

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.

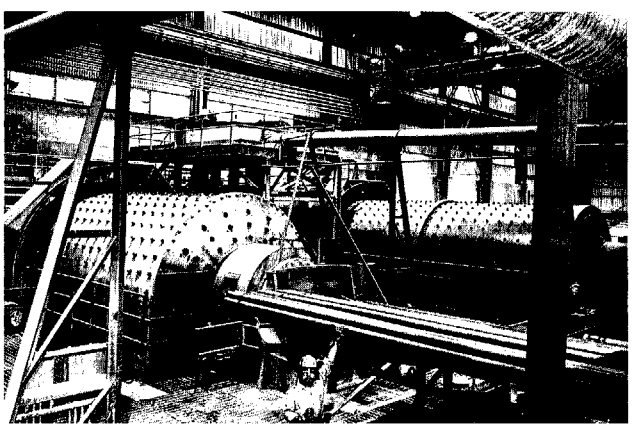
A rod mill is a large steel drum 18½ feet long and 14 feet in diameter which rotates at a speed of 15 RPM. The

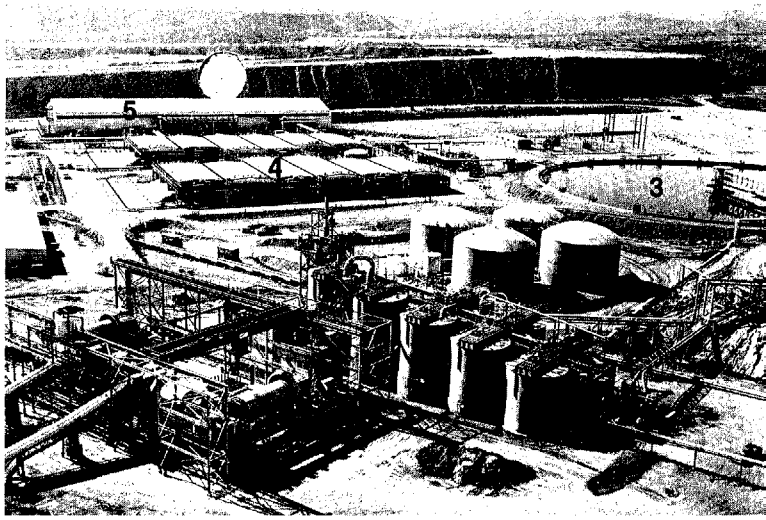


inside of the mill is partially loaded with 4 inch diameter by 17 foot long steel rods. The ball mills are slightly larger and are filled with 2 inch diameter steel balls. (In the picture below, the mill worker stands in front of a rod and a ball mill, holding a steel ball and pointing to the rods.) 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.





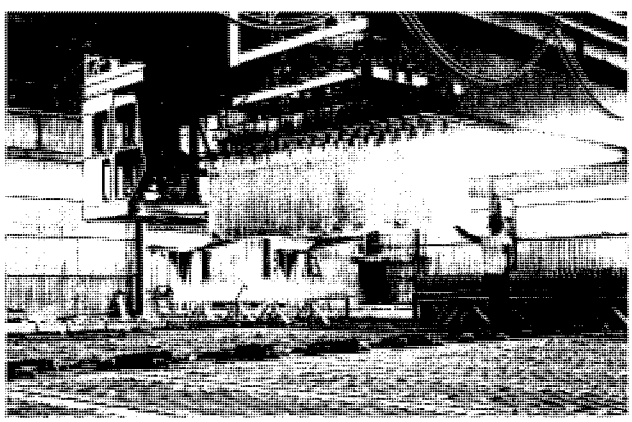
The Oxide Plant

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.

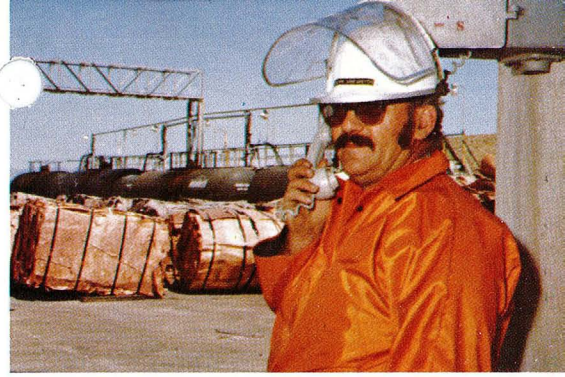
After crushing, oxide ore is fed into rod and ball mills[1] and reduced to a slurry which is then pumped through a series of eight leaching tanks[2]. Sulfuric acid in the tanks leaches the copper minerals from the ore. After eight hours, virtually all the copper oxide has been removed from the ore and is in solution with the acid. It is then fed through a series of four thickener tanks[3], 400 feet in diameter, where the waste or tailing is separated from the acid leach solution.

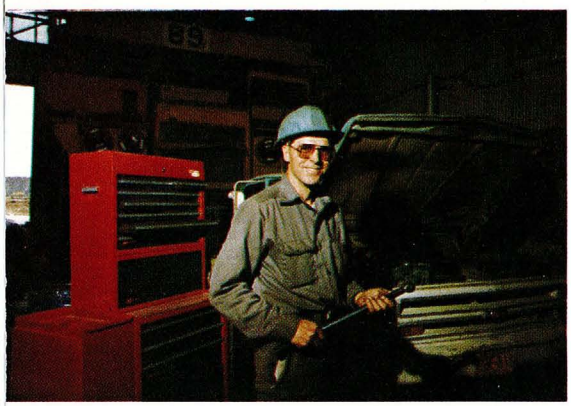
Solvent extraction and electrowinning are the two final steps in producing pure copper from oxide ore. In solvent extraction[4] a chemical reagent called an organic extractant is mixed with kerosene and is used to transfer the copper out of the acid solution leaving other impurities behind. More acid is then added to separate the copper from the organic solution and prepare it for electrowinning.

In the tankhouse[5], 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.



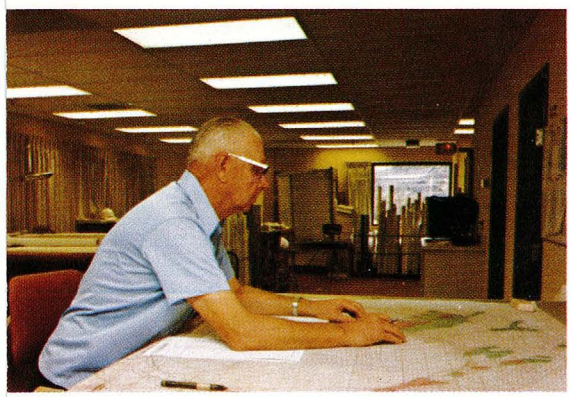


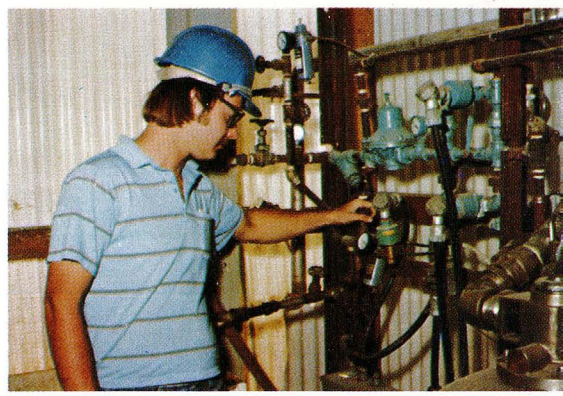
Anamax People

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 6½ 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.