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# ROUND MOUNTAIN

Stacking ore on the heap leach pad, with the gold bearing pregnant solution in the foreground

**Smoky Valley Mine**

**AN INTRODUCTION FOR VISITORS**

ROUND MOUNTAIN

September 1985

The Past to the Present

Round Mountain is located on the east side of Big Smoky Valley (the western slope of the central Toquima Mountain range) in Nye County, Nevada, about 55 miles north of Tonopah.

Two ranchers, John F. Stebbins and Frank Dixon, located the Sunnyside claims on the southwest side of Round Mountain in late February 1906, near the site of earlier excavations. A few days later, Luther Morgan and L.R. Scott of Manhattan discovered rich showings of free gold and in seeking the source, they came upon the same workings and filed the Los Gazabo claim March 3. It was their publicity that brought the district to the attention of the mining world.

A major legal battle threatened when it was determined that the Los Gazabo claim was within the boundaries of the three earlier Sunnyside claims. Litigation was averted when a group of investors from Goldfield, Nevada, purchased the Sunnyside claims, satisfied the claims of other litigants and formed the Round Mountain Mining Co., which began operations in April, 1906.

By August, the Round Mountain Mining Co. had installed a two-stamp experimental mill on nearby Shoshone Creek for the Sunnyside Mine. Eventually it was enlarged to a 100-ton per day capacity. The first large stamp mill in the district, with a 20-ton capacity, was erected to treat ore from the Fairview Mine.

Round Mountain's placer gold, carried away from the original lode by weathering, was discovered by Thomas Wilson in September 1906. He secured leases on the land owned largely by Round Mountain Mining Co. and by operating two drywashing machines, he reportedly made $800 to $1,000 a day.

He realized that if water were available, hydraulicking the placer deposits would produce even greater profits in much less time. Water rights to Jefferson and Shoshone Creeks were purchased from Stebbins and Dixon, and a pipeline was built to the gravel deposits. When the leases expired in 1914, Round Mountain Mining tried its hand at hydraulicking by leasing the water rights to Jett Creek across the valley and built a 15-inch pipeline nearly eight miles long to the deposits. In 1916 it also acquired the water rights to Jefferson, Shoshone and Indian Creeks as well. Various mining companies were consolidated and in 1928/29 became Nevada Porphyry Gold Mines. The company made a major effort in 1929 to sample the underground workings and dumps to justify an open pit, but nothing came of this.

Underground operations ceased in 1935; placer mining continued until 1940. A. O. Smith Corp. of Milwaukee optioned the property and carried out an extensive underground sampling program in 1936. The low grade mineralization was identified but was not economic at prevailing gold prices.

Yuba Consolidated, Fresnillo and Consolidated Goldfields formed Round Mountain Dredging Co. in 1946 to work the placer deposits. By 1949 it had built a $3 million concentrating plant and bought $1 million worth of equipment. With Yuba as operator, the project lost $2 million in the succeeding 34 months.

Fresnillo bought Yuba's interest and spent five years examining the property further before contracting with Morrison-Knudsen in 1957 to remove 33 million yards of overburden and mine nearly 12 million yards of pay gravel. After 22 months the operation had produced about 100,000 ounces of gold, showing a profit of $750,000. The stripping ratio became excessive and forced the operation to shut down.

Throughout the 1960's, Nevada Porphyry Gold Mines attempted to sell the property. Copper Range Company became involved in 1970 when it assumed an option held by Ordrich Gold Reserve Company, a group of airline employees from the Los Angeles area. Ordrich and Copper Range were primarily interested in the placer potential. A major feasibility study was completed by the Fluor Corporation in 1972. Their findings indicated that a placer operation would not be economic but that there was potential for the lode ore.

Based on the underground sampling of the A. O. Smith Company, a reserve of 12 million tons of ore at a grade of 0.06 ounces gold per ton and a 1 to 1 stripping ratio was developed. In November 1972 Copper Range exercised its option to acquire the property. Ordrich was unable to arrange financing and gave up its position for a net profits interest. Felmont Oil Corporation (acquired by Homestake Mining Company in July 1984) and Essex Royalty Corporation (which later became Case, Pomeroy & Company) each acquired 25 percent interest in the property, with Copper Range holding 50 percent and being the operator.

Mountain States Engineering performed test work, designed and constructed crushing, heap leaching and metal recovery facilities to process 7,000 tons of ore per day. The first dore bar was cast on February 22, 1977 from what is now known as the Smoky Valley Mine. In May 1977 all the shares of Copper Range were purchased by Louisiana Land and Exploration Company. Copper Range continued operations as a wholly owned subsidiary of LL&E.

On January 1, 1985, Echo Bay Mines Ltd., a major North American gold producer, purchased Copper Range Company from Louisiana Land & Exploration Company and has assumed operating responsibility for Smoky Valley Mine.

In the 1970s, severe mechanical problems coupled with difficulties in attracting and keeping qualified operators and mechanics resulted in poor plant performance. Limited reserves made it difficult to justify required remedial actions. A limited exploration drilling program was started late in 1978. By mid-1980, additional proven reserves were developed to allow future planning and justify a moderate capital program.

Major changes and improvements have been made to the original plant and equipment although the basic flowsheet remains the same. Principal changes have been:

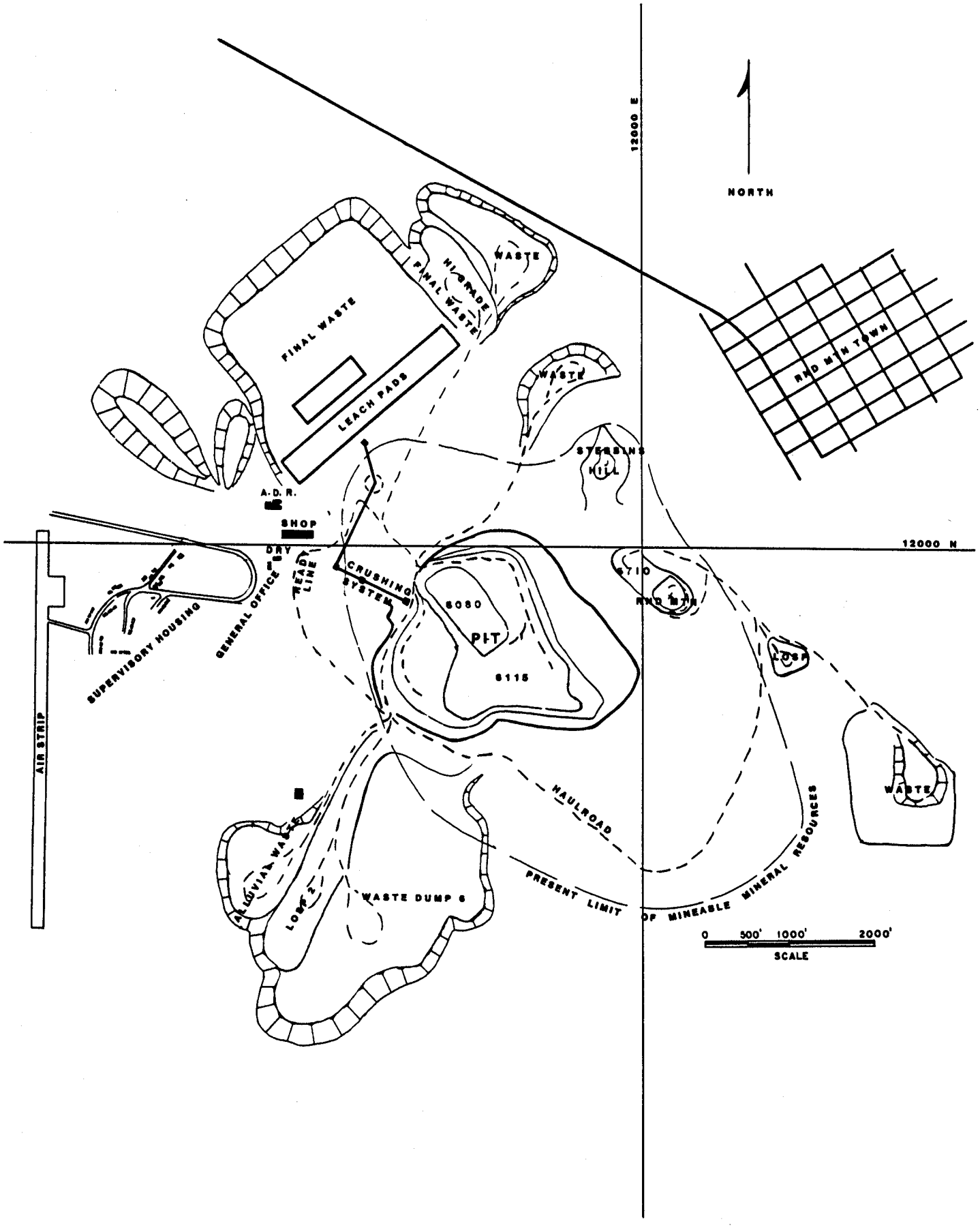
- Mine equipment increased to handle 50,000 tons of ore and waste per day from 14,000 tons per day.
- Modified crusher materials-handling systems that increased tons per day from 7,000 to 14,000.
- Increased leach pad capacity from 250,000 tons to 1,200,000 tons.
- Installed leach solution heating system for cold weather operations.
- Replaced atmospheric pressure carbon strip system with pressure strip.
- Installed facility to add dry lime to ore before leaching.

The results of these improvements are indicated in the following table:

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985* |
|---|---|---|---|---|---|---|---|---|---|
| Tons Leached per Day | 4,042 | 3,988 | 4,839 | 6,094 | 6,430 | 7,693 | 10,047 | 12,785 | 13,397 |
| Stripping Ratio | 0.8:1 | 0.8:1 | 1.6:1 | 1.8:1 | 3.7:1 | 2.1:1 | 2.2:1 | 2.8:1 | 2.8:1 |
| Cash Cost per Ton Leached | $2.55 | $4.36 | $5.26 | $6.26 | $7.21 | $7.37 | $6.91 | $6.59 | $6.21 |
| Annual Gold Production | 37,052 | 49,575 | 45,991 | 57,589 | 58,938 | 72,562 | 93,253 | 121,014 | 60,512 |
| Cash Cost per Ounce Produced | $99 | $125 | $197 | $236 | $280 | $278 | $265 | $251 | $212 |

*First six months 1985

# SMOKY VALLEY MINE



# GEOLOGY

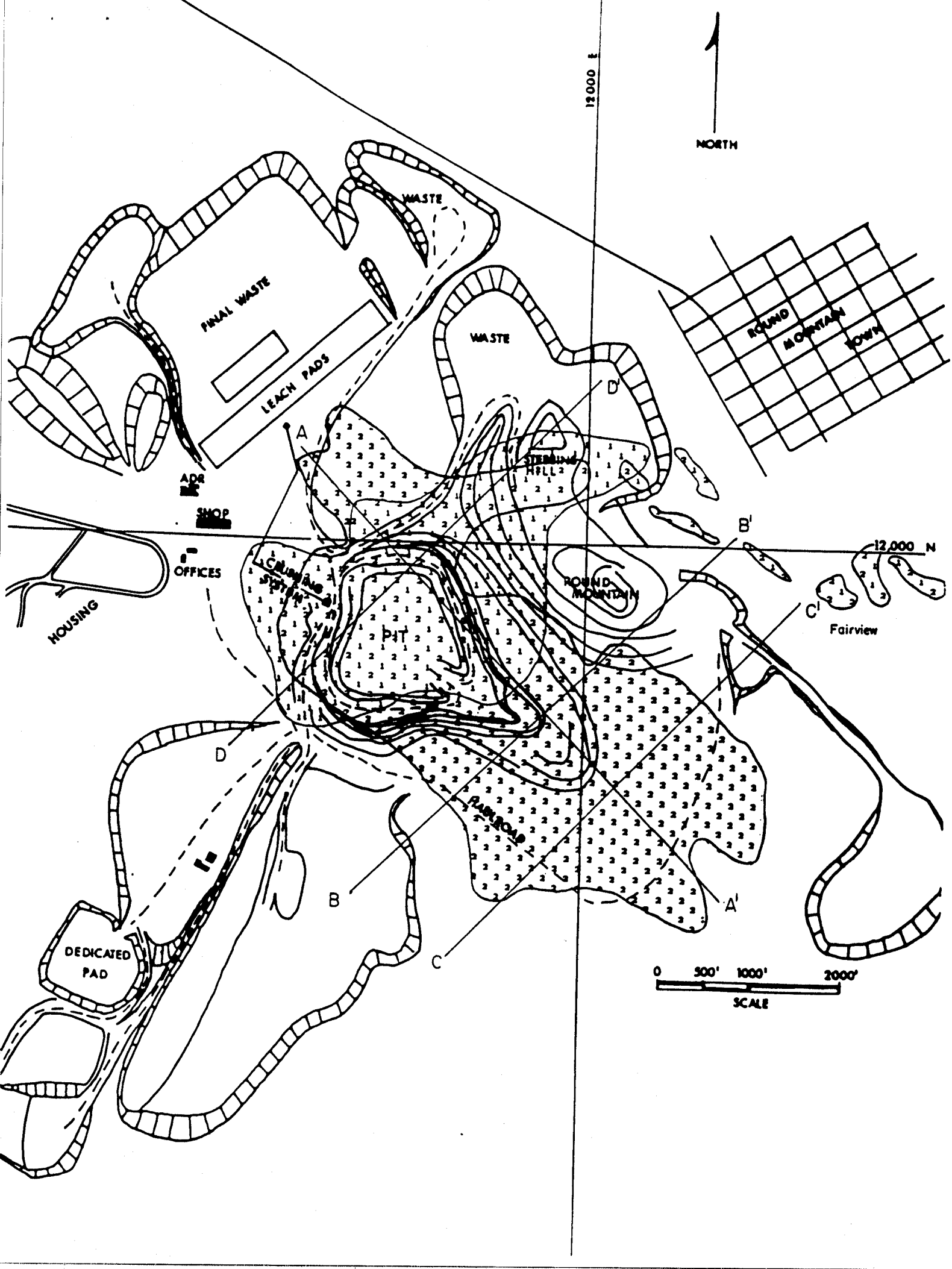
The Round Mountain gold deposit is hosted in rocks of volcanic origin. They can be characterized as rhyolite ignimbrites (ash flow tuff). The upper densely welded unit (Type I ore) contains gold along sheeted joint sets centered on dominantly northwest trending structures. The lower sequence (Type II mineralization) is composed of several sub-units of varying degrees of poorly welded flow, and varying pumice content. The gold is almost truly disseminated in the poorly welded section, with gold deposition highest in the pumice sites. The combined thickness of these two units is plus 2,000 feet. The average thickness through the pit mineable area is 350 feet for the densely welded unit, and 450 feet for the poorly welded unit. The dated age of the volcanics is 26 million years with an age of gold deposition at 25 million years.

The lithic ash flow tuff (Type III locally) is a combination of densely welded tuff with very large pumice (1-4 cm) which reacts like a fracture controlled, poorly welded ash flow. The lithic content is from 15-50+ percent, with size ranges from pebble, to boulder, to slabs in excess of 80 feet thick. The age date on one unit of Type III (Water Tank tuff) is 32 million years, with this unit lying unconformably on two older units of similar tenor and composition.

Mineralogy at Round Mountain is quite simple in terms of treating the ore. The gold occurs as an electrum, which in the mine generally runs 65 percent gold and 35 percent silver. The deposit is anomalous, in that there is an absence of mercury, arsenic and base metals in any significant quantity. Original gold deposition was in two forms: One was electrum and the other was electrum trapped in pyrite fractures or encapsulated in pyrite minerals. Subsequent oxidation of the deposit has left electrum and limonite with electrum. Approximately 80 percent of the deposit is oxidized; the remaining tonnage is composed of mixed oxide and sulfide mineralization, and sulfide mineralization with free gold and gold-bearing pyrite.

The size of gold particles in the densely welded (Type I ore) zone varies widely and ranges from 1/4-inch to 5 microns in size. The size of gold particles in the poorly welded (Type II mineralization) zone is much finer. They vary in size from 1/8-inch to 2 microns, or approximately half the sizes found in Type I ore.

The free gold at Round Mountain causes some problems in assaying due to the effect .5 to 3 millimeter nuggets can have on sample preparation. The problems have been minimized by using 5-assay-ton fire assays from two separate splits and taking an average of both assays.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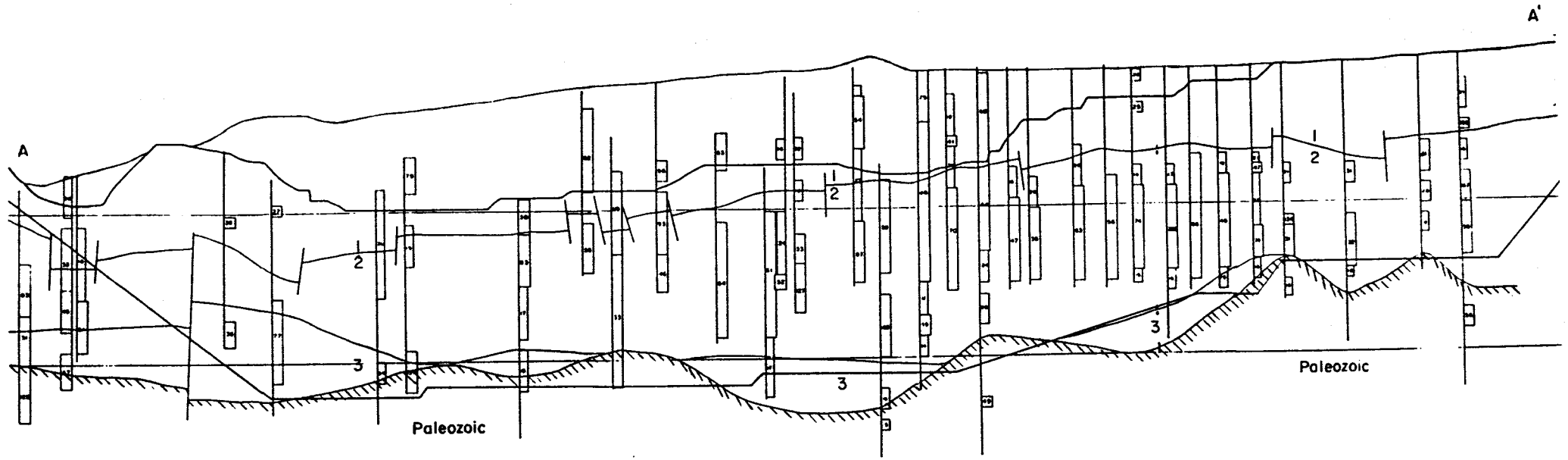
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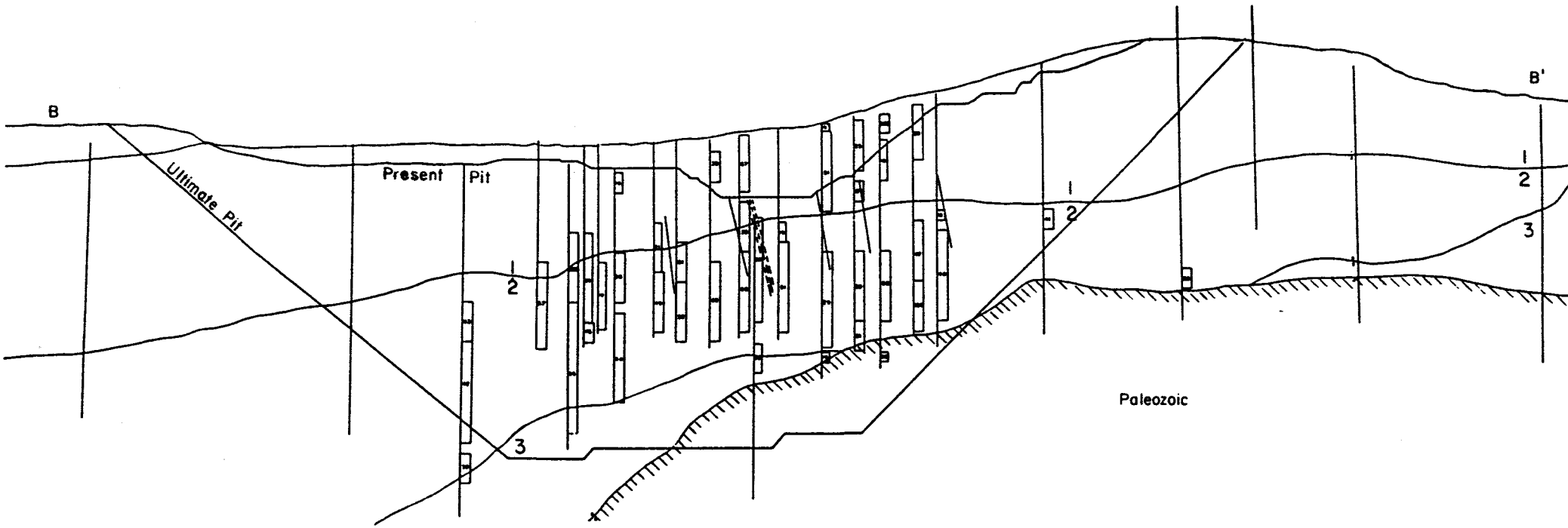
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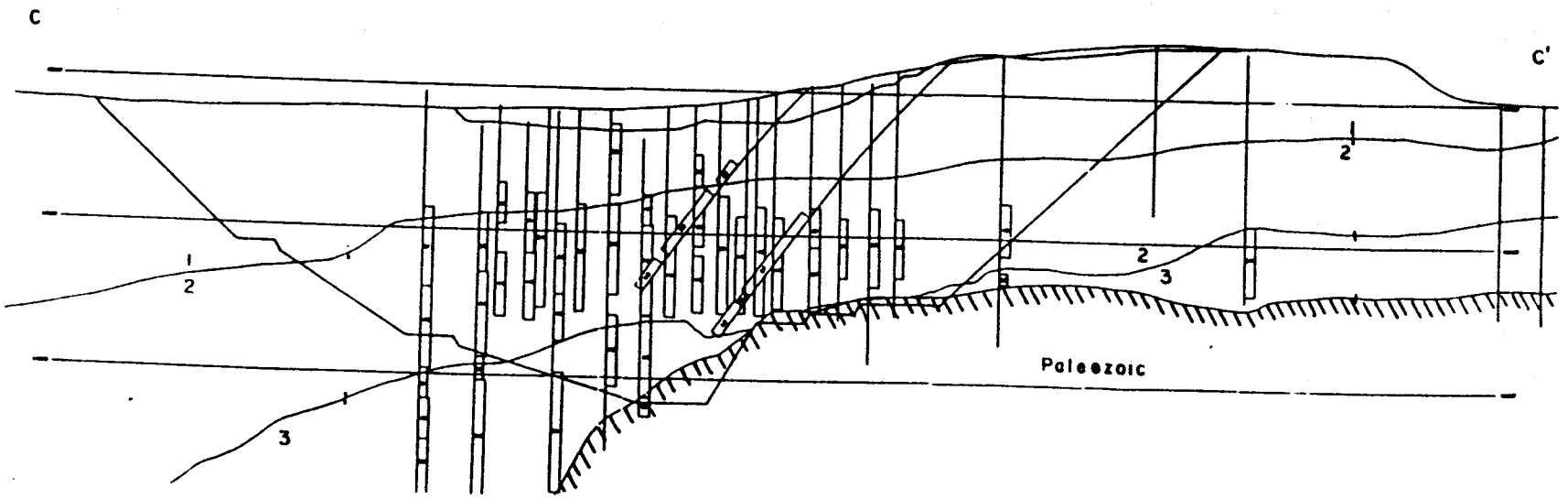
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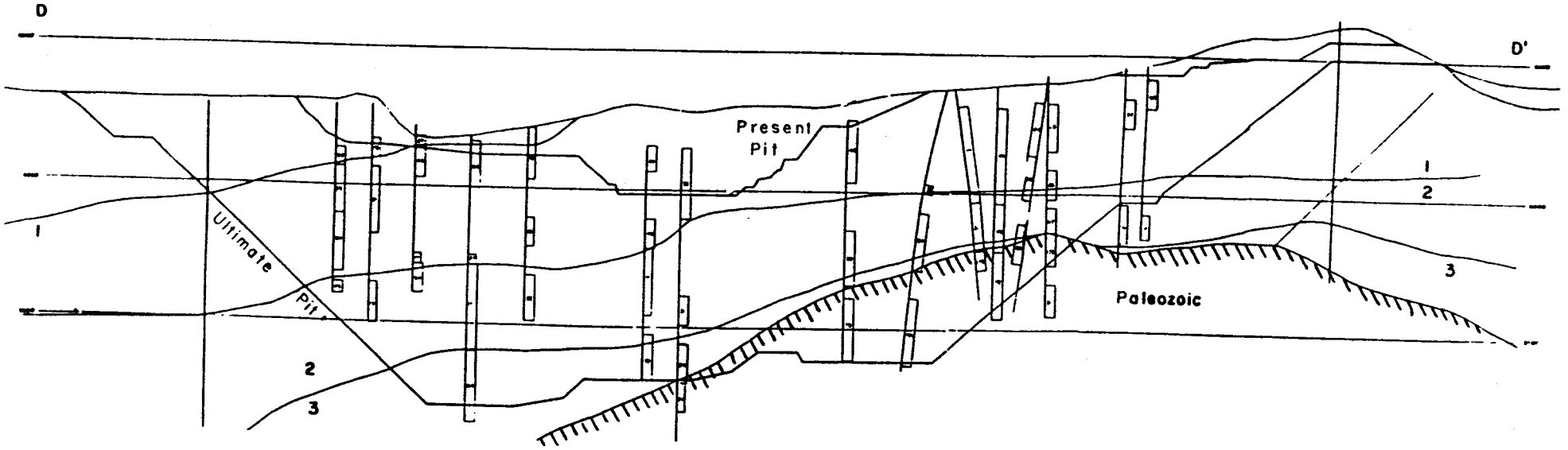
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Drilling to date (the data base has 920 holes with an average depth of 800 feet and 300 holes with an average depth of 175 feet) has defined the following ore and geologic reserves:

Mineable Ore Reserves, December 31, 1986 - $400 Gold

| | Tonnage (@.015 oz./ton) KTons | Grade (oz./ton) | Gold Content (ozs.) |
|---|---|---|---|
| Type I Proven | 46,141 | 0.027 | 1,246,000 |
| Type II Proven & Probable | 140,551 | 0.037 | 5,200,000 |
| Type III Proven & Probable | 7,575 | 0.041 | 311,000 |
| Total: | 194,267 | 0.035 | 6,757,000 |

Geologic Reserves, December 31, 1986

| | | | |
|---|---|---|---|
| All Rock Types All Categories | 406,210 | 0.030 | 12,186,000 |

The reserve was completed by Independent Mining Consultants (I.M.C.) of Tucson, working from a geologically oriented model developed at RMGC. The modeling is an application of geostatistical approaches with Indicator and Linear Keiging being the dominant styles. The resulting I.M.C. block model, which was installed in 1986, has matched tons, grade, and ounces predicted with phenomenal accuracy. This modeling has given RMGC the ability to produce excellent mine plans.

The tertiary ignimbrites overlay either Cretaceous granite or Paleozoic sediments such as quartzites, phyllites, shales, and marls (Type 4 locally). Drilling into the basement is sparse, but many holes have significant mineralized intercepts and significant potential for increasing the reserve exists and subsequently needs to be tested for underground potential.

Round Mountain also contains a substantial resource hosted in eluvial gravels. Based on a 1972 Flor report, an additional 1,000,000 ounces of gold are contained in the volcanic dominated gravels.

# ENGINEERING

## Mine Planning and Control

The Smoky Valley Mine is currently following a plan to exploit the ore in the densely welded tuff, the Type I ore zone. As of January 1, 1985, reserves of Type I ore were approximately 42 million tons at a gold grade of 0.043 ounces per ton.

Most ore production comes from the lower levels of the mine. Waste mining on Round Mountain is exposing ore for future mining.

Presently the ore cut-off is 0.015 ounces gold per ton. Material below the cut-off and above 0.008 ounces gold per ton is designated as lean ore and placed in a separate dump. Material with less than .008 ounces gold per ton is waste.

Because the gold occurs on fracture surfaces, it tends to concentrate in the fines created by the blasting, loading, hauling and dumping operations. When lean ore is dumped, fines tend to remain at the top of the pile, resulting in the upper third of the dump naturally upgraded to ore quality.

Mining and treatment rate scheduled for the last half of 1985 and for the year 1986 is 14,000 tons per day crushed ore and 4,000 tons per day uncrushed, upgraded lean ore removed from the top third of the lean ore waste dump.

## Type II Program

A 25-ton sample of the substantial Type II mineralization has been collected by drilling 6-inch core. Preliminary column leach tests on this material have been successful, and more extensive tests are now underway.

If these tests demonstrate that Type II is economically recoverable, this mineral inventory of 111 million tons, grading 0.039 troy ounces per ton, will be upgraded to ore reserves. Should this occur, expansion of mine capacity will be studied, with a possible target of doubling production.

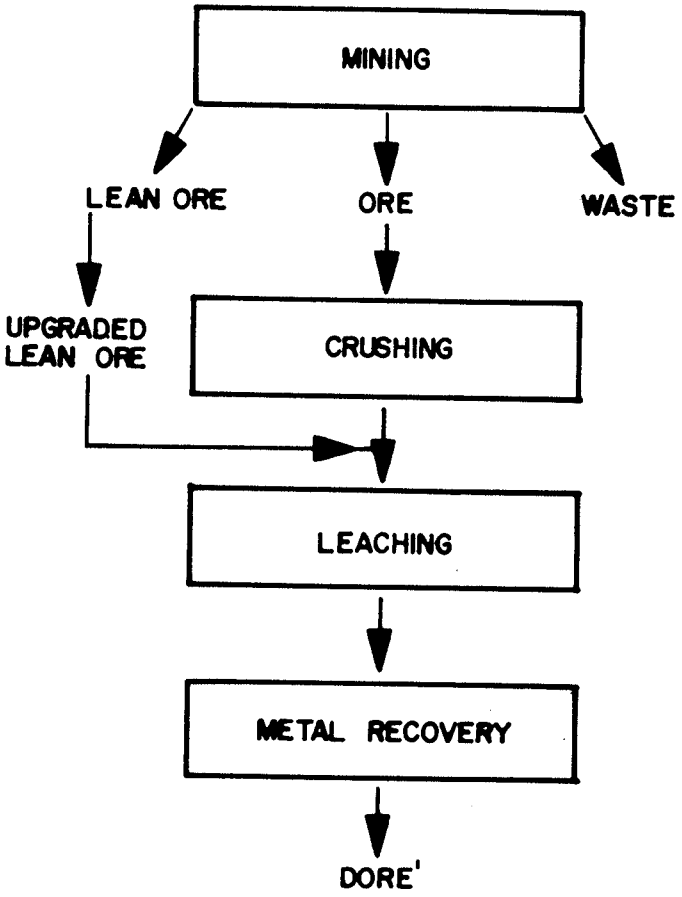
# THE SMOKY VALLEY MINING OPERATION

As with most mining operations, the Smoky Valley Mine not only breaks the rock but also classifies the material broken and excavated, and processes the material according to its value.

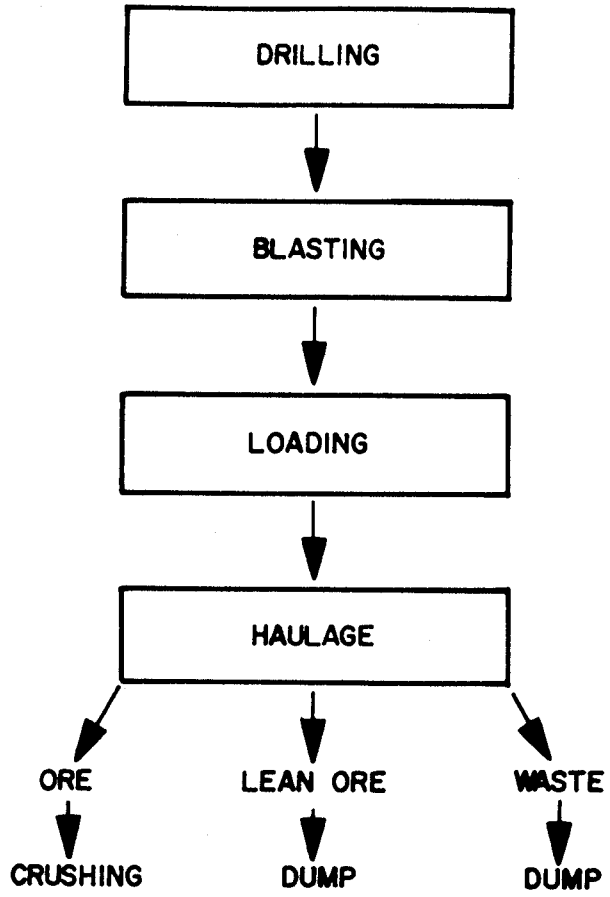
The ore is crushed and heap leached; the lean ore is upgraded by natural segregation and about a third is heap leached; and the mine waste is dumped.

The gold and silver dissolved by leaching are recovered and become the final dore metal product.

In the following pages the various processes are described in greater detail.



## MINING




Mining activities at Round Mountain take place 24 hours per day seven days per week with nine days per year non-scheduled due to holidays. The mining method employed is an open pit designed with 35-foot bench heights. At September 1985, the pit is approximately 3,000 feet long, 2,000 feet wide, and 200 feet deep with current activity focused in the pit bottom and on the top of Round Mountain.

The mining cycle starts with drilling blast holes. Four rotary blast hole drills are used to drill 7-7/8-inch diameter or 9-inch diameter holes on an 18-foot by 18-foot square pattern. Each blast hole is numbered, surveyed, sampled, and assayed. From this information the engineering department prepares a digging plan which the mine department follows after blasting.

After a drill pattern is completed the blasting crew measures each hole and designates the delay pattern and explosive load. Actual field loading follows the shot design with ammonium nitrate/fuel oil being the main explosive and the Nonel non-electric delay system being used for hole detonation. Actual blasting takes place five days per week at the end of the day shift.

The engineering department places color-coded flagged stakes in the broken muck piles to denote waste, lean ore, and ore. The loader operators

utilize these flags to determine where the truck drivers are to dump the material. Trucks are loaded with 12-cubic yard Caterpillar 992-C loaders, an 11-cubic yard Hitachi UH-801 hydraulic excavator, and a P&H 7-yard electric shovel. The truck fleet is comprised of 85-ton Unit Rig trucks, 85-ton Wabco trucks and 50-ton Euclid trucks. The three different classes of material are delivered by truck to the waste dumps, lean ore dumps, or crusher, as determined by the digging plan.

## List of Major Mining Equipment

### Loading Equipment

1 P&H 1600 electric power shovel - 7 yd

1 UH 801 Hitachi hydraulic excavator - 11 yd

6 992C Caterpillar rubber-tired loaders - 12 yd, 2 with extended arms

### Haulage Trucks

9 50-ton Euclids

6 85-ton Wabcos

4 85-ton Unit Rigs

### Dozers

2 D-9L Caterpillar track dozers

3 D-8 Caterpillar track dozers

1 824 Caterpillar rubber-tired dozer

### Graders

2 16G Caterpillar graders

### Drills

2 Reed SK-40 track-type diesel hydraulic drills

1 Bucyrus Erie 45R track-type diesel electric drill

1 Joy TR60 truck mounted diesel hydraulic drill

1 Gardner denver hydra track drill

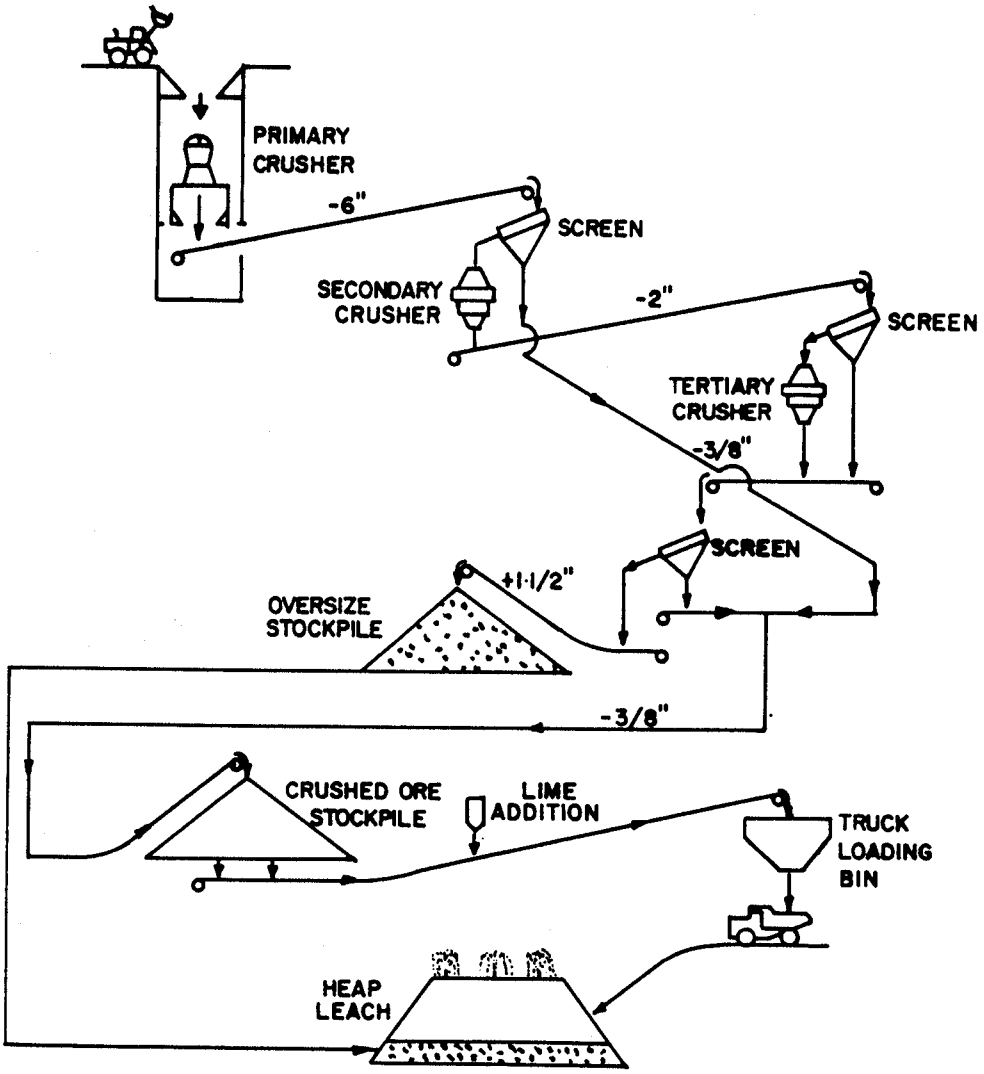
### Explosives Handling

2 ANFO (ammonium nitrate/fuel oil) explosives trucks with automatic mixing and dispensing of ANFO and slurry emulsion

### Water Truck

2 6310 Caterpillar Magnum 10,000-gallon water trucks

# CRUSHING




The crushing system processes approximately 14,000 tpd of run-of-mine ore and produces a nominal 3/8-inch product with an open crushing circuit. Crushing takes place around the clock with an 8-hour scheduled maintenance shift once a week. Operational personnel consist of a crusher operator and assistant on each shift, one crusher foreman, and one crusher oiler.

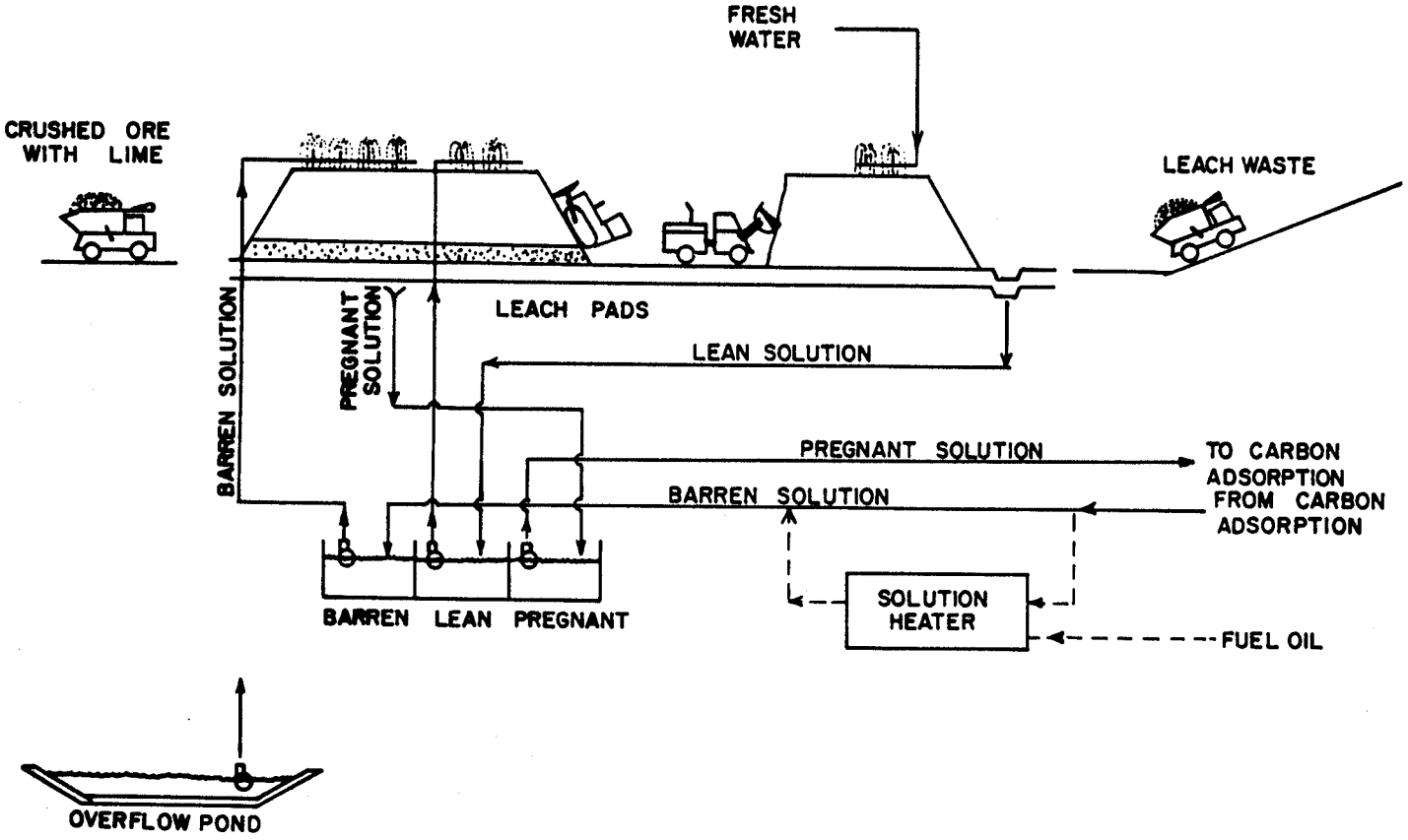
The primary crusher is an Allis-Chalmers 42"x65" gyratory crusher with hydroset for size control. Run-of-mine rock is reduced to a nominal 6-inch product and is loaded onto a conveyor belt via a 42-inch by 20-foot apron feeder. The secondary crusher is protected from tramp metal with a magnet and metal detector located on the conveyor ahead of the crusher.

A 6-foot by 12-foot vibrating screen separates the -3/8-inch fines which

bypass the secondary and tertiary crushers. The screen oversize is fed to the 7-foot Nordberg heavy-duty standard cone crusher (secondary crusher). Crusher discharge is a nominal -2-inch produce which is conveyed to a splitter which directs the feed to two 6-foot by 12-foot vibrating screens. The fines report directly to the conveyor and the +3/8-inch material reports to two 7-foot Nordberg heavy-duty shorthead cone crushers (tertiary crushers). Crushed product is then loaded on the conveyor discharging into the 6-foot by 20-foot vibrating screen used to scalp the +1½-inch material. The undersize reports to a surgepile capable of 32,000 tons live storage. The surgepile is equipped with three vibrating feeders loading ore onto a conveyor belt which feeds an automated truck loading bin. Lime is added to the ore just before discharge into the truck bin.

Leach pad loading and unloading is a continuous process starting with trucks being loaded at the truck bin. The trucks discharge ore at the base of the leach pile where a D-9L bulldozer pushes the ore to an average height of 35 feet. The +1½-inch scalper product is placed on the bottom of the leach pile to improve leach solution movement. Unloading of a fully leached section of the pad takes place concurrently with loading ore on a new section. The tailings are loaded onto trucks and are dumped directly west of the leach pads.

# LEACHING




After crushing, the first step in processing is to mix in quicklime at an application rate of 3.0 pounds lime per ton of ore. Coarse lime is applied to the ore and sprayed with water as it moves by conveyor to the truck loading bin. By mixing in this manner, there is a near homogeneous mix of ore and lime when the ore is ready for leaching.

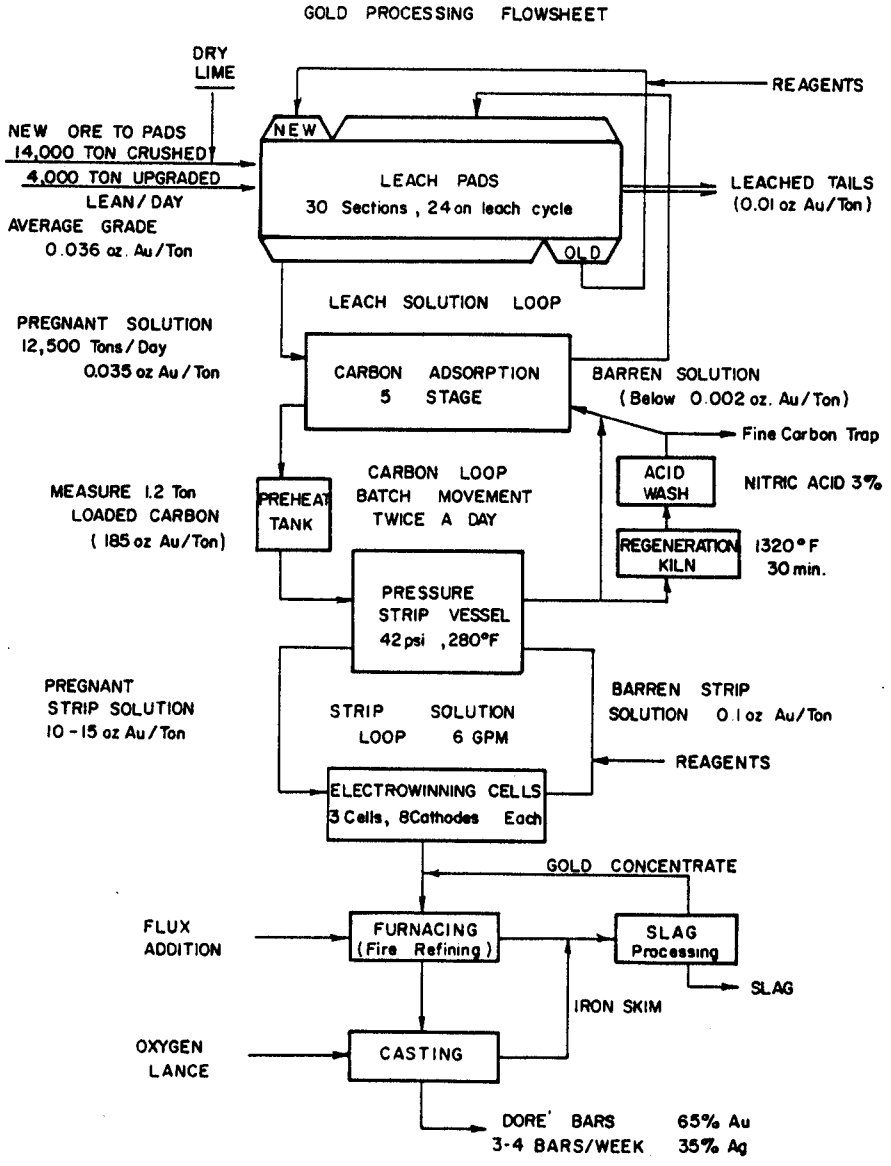
The leaching pad is constructed of 7 inches of asphalt with an internal rubberized layer. The leaching pads are about 3,200 feet in total length, 280 feet wide, and the stacked ore covers an area of about 800,000 square feet. The asphalt pad slopes to the collection ditch at a 4 percent grade; the collection ditch slopes at a 1 percent grade to the south. Operationally, the leaching area is subdivided into 30 individual leaching sections, each fed by one 3-inch pipe line. Before ore is loaded onto the pads, a base of scalped oversize ore is spread over the asphalt to protect the asphalt from the large equipment and to aid the drainage of the pregnant solution.

# THE GOLD RECOVERY PROCESS

The gold recovery process used at SVMD is "Heap Leaching - Carbon Adsorption - Electrowinning".

Gold in the crushed ore is dissolved by a dilute sodium cyanide solution. This gold is then removed from the pregnant solution by adsorbtion onto activated carbon. Under conditions of heat and pressure, the gold is stripped from the activated carbon, becoming a high grade solution that is suitable for feed to electrowinning cells.

The gold is electrolytically precipitated onto steel wool cathodes in the electrowinning cells. The cathodes are then fire refined to remove iron and other impurities. Dore metal containing about 65 percent gold and 35 percent silver is the final product. This is shipped to a refiner for refining to a marketable purity and is then sold.

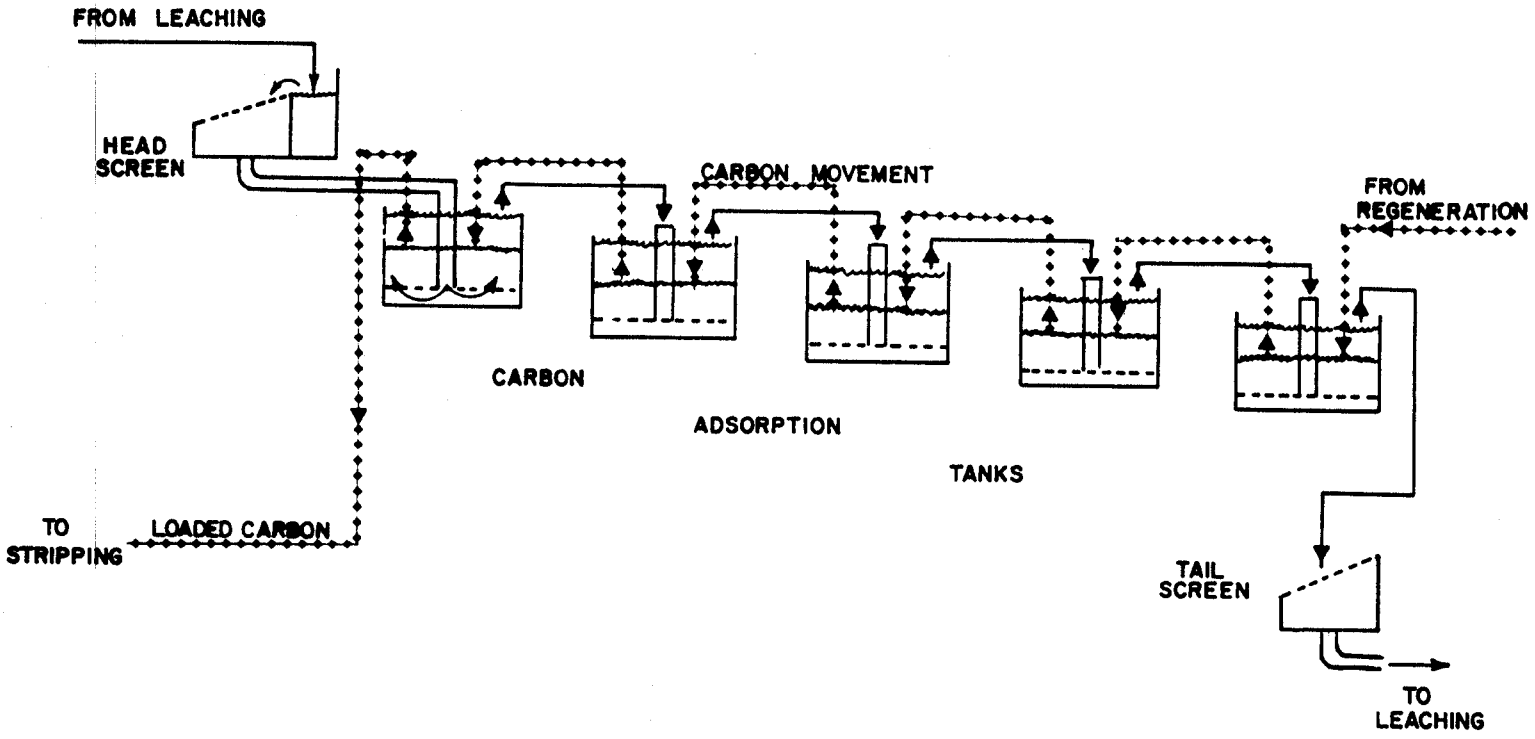


Ore is loaded onto the pads at a rate of 18,000 tons per day, consisting of 14,000 tons of crushed ore and 4,000 tons of upgraded lean ore. The average grade of crushed and upgraded ore will be about 0.036 troy ounces gold per ton, or just over one part per million. The ore is stacked 35 feet high and leveled by a D-9 tractor. High density polyethylene 2-inch pipes with wobbler sprays on 25-foot centers are placed on top of the ore, and leaching is started. A weak cyanide solution is distributed at a rate of 0.004 gallons per minute per square foot. The leach solution contains one pound dissolved sodium cyanide per ton of solution. The leaching time is determined by the total volume of ore on the pad system, about one million tons, and the feed rate of new ore. At current feed rates, three new individual pad sections are put under leach each week, equivalent to 55 days of leaching per section. At the same time three pad sections per week are removed from leach to be drained, washed and unloaded, then loaded with new ore. Five individual pad sections are usually in transition. The pH of the solution during leaching is maintained by the lime in the ore.

During winter the leach solution is heated to maintain flow rate through the pads so that gold extraction can continue.

In 1984, with a 44-day leaching cycle at 12,500 tons per day, 66.7% of the gold contained in the ore was recovered. By stacking the ore an additional 10 feet in 1985 and by increasing the pad length by 25%, the leaching cycle has been extended to approximately 55 days at about 18,000 tons per day. The recovery rate is now expected to exceed 70%.

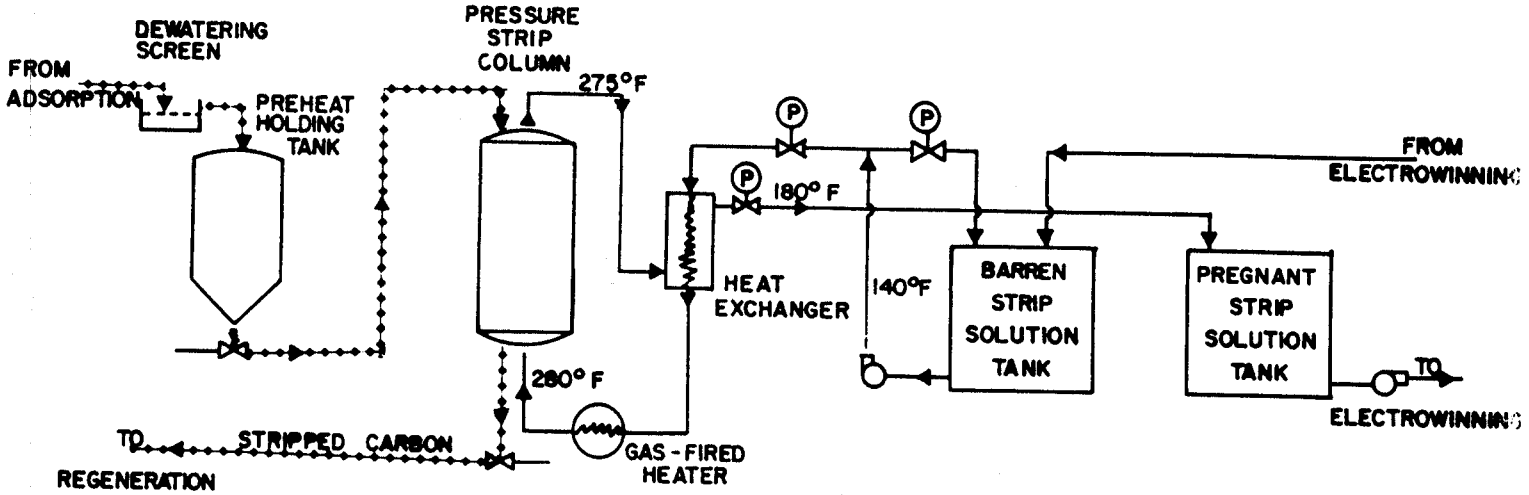
# CARBON ADSORPTION




Pregnant solution, containing from 0.035 to 0.045 troy ounces gold per ton of solution, is pumped to the carbon adsorption plant for gold and silver recovery. The carbon adsorption circuit consists of five carbon tanks connected in series. Each tank contains 3½ tons of activated coconut shell carbon granules. The activated coconut shell carbon contains an amazing 1,000-1,200 square meters of surface area per gram of carbon! The adsorption tanks are 11 feet 8 inches in diameter. Solution travels down a centerwell and up through a distribution plate and through the carbon bed. Solution is pumped through the plant at 2,250 gallons per minute. Actual contact time with the carbon in all five tanks is about six minutes. In that time the plant adsorbs approximately 97 percent of the solution gold. Barren solution from the plant returns to the barren sump where make-up cyanide is added and the solution is returned to the leach pads.

Carbon is moved through the tanks on a batch basis, in a counter-current direction to the solution flow. About 1.2 tons of loaded carbon is removed from the first adsorption tank (the last tank in the carbon cycle) to the preheat tank every 12 hours. The carbon levels in each tank are measured, and carbon is moved up the line. Reconditioned stripped carbon is then added to the fifth tank.

# CARBON STRIPPING



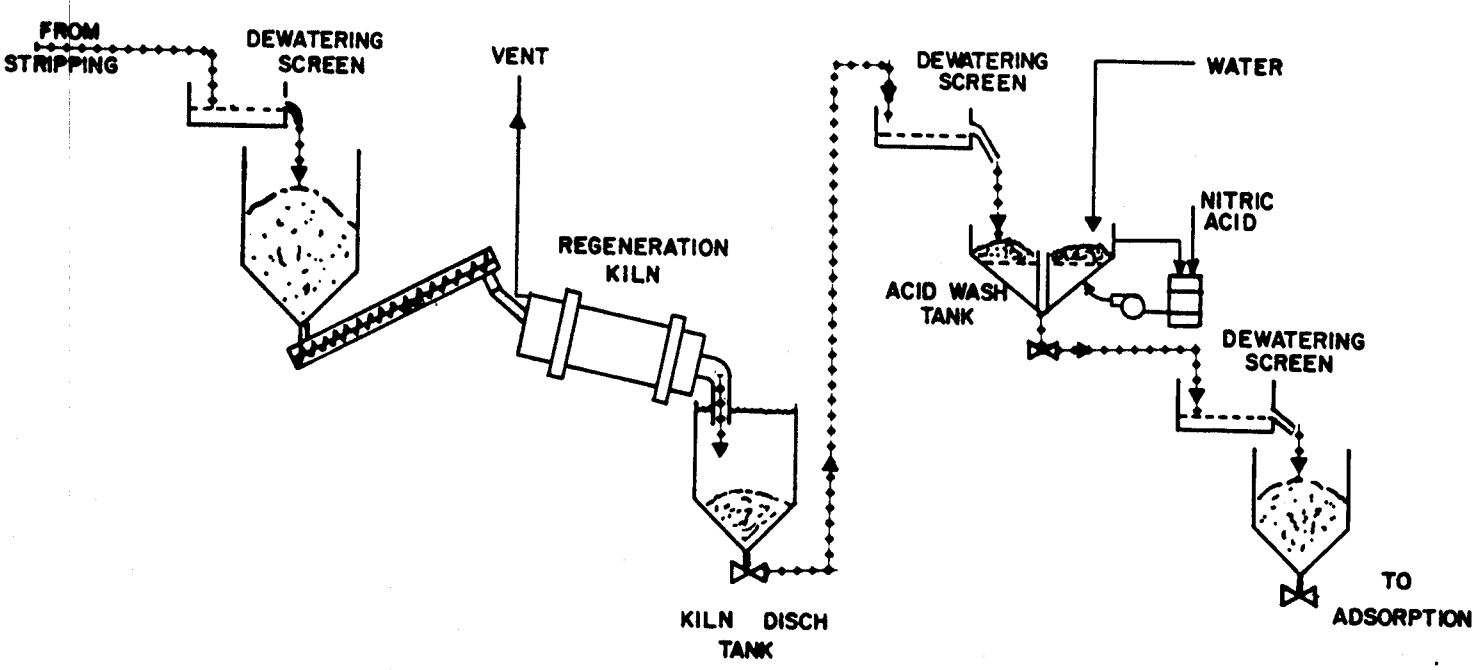

Because the pressure strip vessel is a closed container, the preheat tank is used to measure the proper amount of loaded carbon for stripping. Every 12 hours the measured carbon in the preheat tank is moved into the pressure strip vessel. The strip tank is a pressure rated vessel 2½ feet in diameter, 17 feet high, made of stainless steel, and insulated. Gold and silver adsorbed onto the carbon surfaces at ambient temperature are desorbed from the carbon at elevated temperatures. Pressure stripping, or desorption, is a batch operation conducted at 280°F and 42 psi pressure. At this temperature, strip solution containing 5 pounds sodium cyanide and 10 pounds caustic soda per ton, is pumped through the carbon at 13 gpm.

A heat exchanger in series with a gas-fired heater are used to heat the strip solution on its way into the strip vessel. The loaded strip solution flows through the other side of the heat exchanger and cools down to 180°F before exiting the system through the back pressure regulator.

Actual stripping takes 6½ hours per batch. About 4,300 gallons of solution are displaced through the strip vessel. After stripping, fresh water is used to displace the last volume of hot solution and to cool the carbon. Water pressure is used to move the stripped carbon from the strip vessel to the regeneration holding tank.

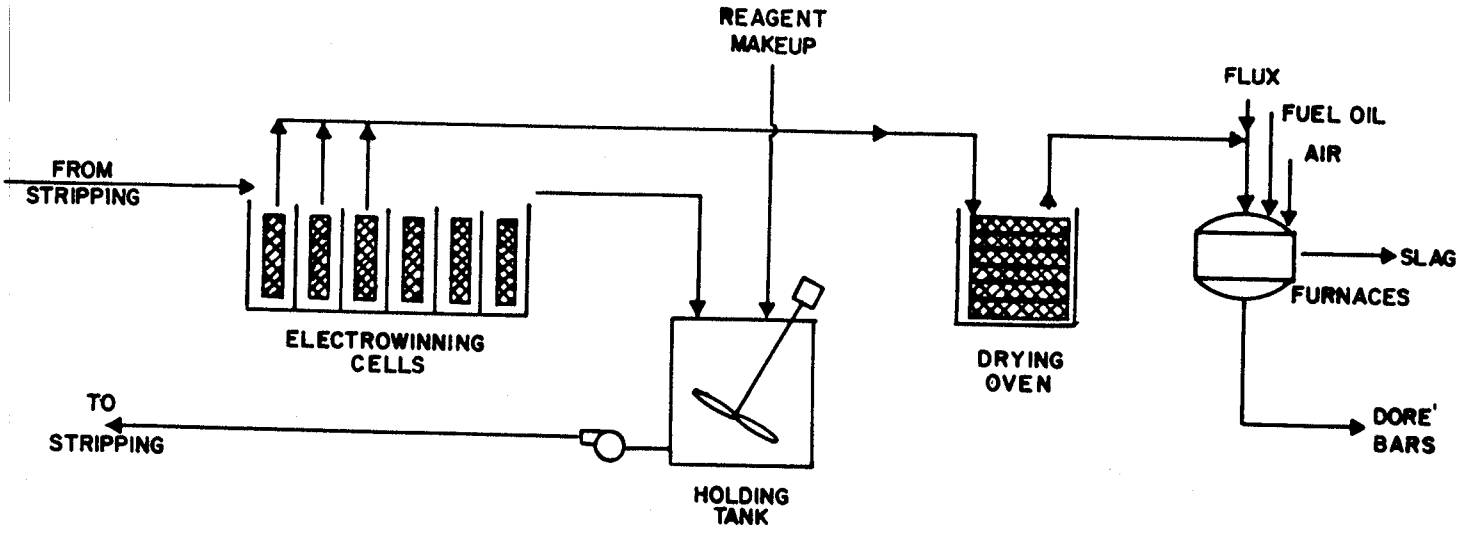
Pregnant strip solution is accumulated in a holding tank and is metered continuously at 6 gpm to the electrowinning cells. The solution contains 10 to 15 troy ounces of gold per ton.

# CARBON REGENERATION




The activity of stripped carbon is restored before it is reused to adsorb more gold and silver. Stripped carbon is dewatered and then thermally regenerated at 1,300°F in an oil-fired indirect rotary kiln. The hot carbon is discharged from the kiln through a water seal to cool it and to prevent its oxidation. The carbon is then educted to a screened tank where it is washed with 3 percent nitric acid solution to clean its surfaces and remove impurities. Acid washing is done in a separate room from other operations. The carbon is then rinsed, basisfied (made alkaline) and returned to the adsorption circuit.

# ELECTROWINNING AND REFINING




Gold and silver are removed from loaded strip solution in three parallel electrowinning cells. The cells are 2 feet wide, 43 inches long and have a solution depth of 30 inches. Each cell contains seven stainless steel anode plates and six flow-through steel wool cathodes. Electrowinning current is at 150 amps per cell or approximately 2½ amps per square foot of anode area. Only 3 to 4 volts are required to drive the current. The loaded solution flows through the cells, while the current passing through the solution plates the gold and silver on the steel wool cathodes. Cathodes remain in the electrowinning cells for 10 days. Twice weekly two cathodes are removed from each cell, the other cathodes are moved up in sequence, and two new cathodes are added to the cells. The loaded cathodes are dried, weighed and mixed with fluxing reagents (silica, nitre, and borax) before fire refining. The cathodes are fire refined and poured into buttons. After the dore' buttons are weighed, they are remelted, and oxygen lanced to remove residual iron, then cast into bars.

This product, called "dore' metal," containing 2/3 gold and 1/3 silver, is shipped to a precious metals refiner for further processing. Slag from fire refining is crushed and tabled for recovery of entrained gold before being sold to a smelter.

Barren solution from electrowinning flows by gravity to an agitated holding tank where reagents are added before it is returned to the stripping section.

# MAINTENANCE

Maintenance activity at SVMD falls into three basic categories:

1. Preventive Maintenance - This includes routine lubrication, oil changes, oil and air filter changes, basic mechanical checks. All equipment is PMed at scheduled intervals.
2. Scheduled Maintenance - Major equipment units such as crushers, shovels and loaders with predictable wear componenets have major maintenance jobs on a scheduled basis.
3. Breakdown Maintenance - Unfortunately a major part of maintenance work. When it breaks-- fix it.

Maintenance is supported by the Materials Manager and his staff who provide purchasing and warehousing services.

Maintenance and operating management work closely together to balance equipment availability with production requirements.

# ASSAY LABORATORY

An efficient assay laboratory is the absolute key to operating a low-grade gold mine.

The ore at 0.040 ounces gold per ton contains 1.37 parts per million gold by weight or about 0.18 parts per million by volume. Ordinarily, gold is not visible in the rock and the only means of determining what is ore is by assay.

Each drill hole is sampled after drilling, and duplicate 5-assay-ton assays are run on each sample. The averaged results form the basis of segregation of broken material into ore (+0.015 ounces per ton), lean ore (0.008 to 0.014 ounces per ton) or waste (less than .008 ounces per ton).

Solution samples from the ore processing plant are assayed for gold and silver. These range from the barren solutions returned to the leach pads at less than .0004 ounces per ton, to the electrowinning heads solution at more than 15.0 ounces per ton. These assays are run on an atomic absorption spectrophotometer, a very fast and accurate instrument that is coupled to a computer that does the analysis and gives a digital readout of the value in troy ounces per short ton.

Other routine analyses include:

Geochemical samples
Dore samples
Carbon samples
Lube oil samples (for contaminants)

The assay laboratory is staffed to operate three shifts per day, seven days per week.

# SAFETY & TRAINING

The safety program is based on an all-employee participation concept. This includes hourly employees holding weekly safety meetings in all departments with material for the meetings furnished by the supervisors.

Incentive-type aspects of the program include prizes, hat stickers and quarterly bonus deductions for lost-time accidents.

Training is provided for employees as follows:

1. New miner-- 24 working hours for all inexperienced employees and also new hires with over a 12-month absence in certified mining employment.
2. Newly employed experienced-- 8 hours for employees having worked at least 12 months of the previous 3 years and have current certification.
3. Annual refresher-- 8 hours for currently employed miners, may be given over a period of time in 30-minute blocks or longer.
4. Task training-- instruction given by a qualified trainer who has demonstrated adequate job skills.

The medical part of the program includes a Certified Physician's Assistant on the property and a 1985 4x4 ambulance capable of handling up to 4 patients.

Listed below is a statistical review of the safety performance of the operation over the last 5 years.

| | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Average Number of Employees | 201 | 266 | 235 | 246 | 303 |
| Lost Time Accidents | 27 | 31 | 19 | 10 | 7 |
| Disabling Injury Rate (lost time accidents per 200,000 manhours worked) | 13.7 | 12.3 | 8.4 | 4.0 | 2.4 |

## THE PEOPLE INVOLVED

Round Mountain and Smoky Valley Mining's remote rural location has required that special attention be paid to the general welfare of employees. On a limited basis, concerns regarding housing, schools, stores for basic needs, and medical and recreational facilities have been addressed. The employee turnover rate, which was more than 100 percent in 1977 and 1978, has been reduced to less than 20 percent.

Improvements in the overall quality of the workforce has been, and remains, a priority. The major programs in this area are:

- Daily evaluation of employees by supervisors in order to identify problems at an early date.
- Employee counseling services either on a voluntary or referral basis.
- Use of a polygraph to discourage theft, equipment abuse, and use of drugs and alcohol on the job.
- Hiring mostly experienced persons. Extensive background checking and polygraph screenings are carried out before hiring.
- Employee involvement in improvement programs. A formalized program of general crew meetings in which problems affecting performance are identified; assignments for developing solutions are made involving managers, supervisors and hourly personnel. Reporting and following up are done at subsequent meetings.
- Incentive bonus programs geared to productivity, cost and safety performance.

Smoky Valley Mining is union-free and believes that with proper treatment of employees, unions have nothing to offer. With an open door policy at all levels, the number of serious employee grievances to reach senior management level has been reduced to practically nil.