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Tucson
Tiger
Tailings Pond
Mahala Mine
Mammoth Mine
Ford Mine
Power House
San Manuel Copper Mine
Tank
Schultz Spr
Wash
Mammoth
San Manuel Copper Mine
T8S R16E Sec. 36 NE
Mammoth 7.5'

San Manuel leaching project.

As of 6-25-85

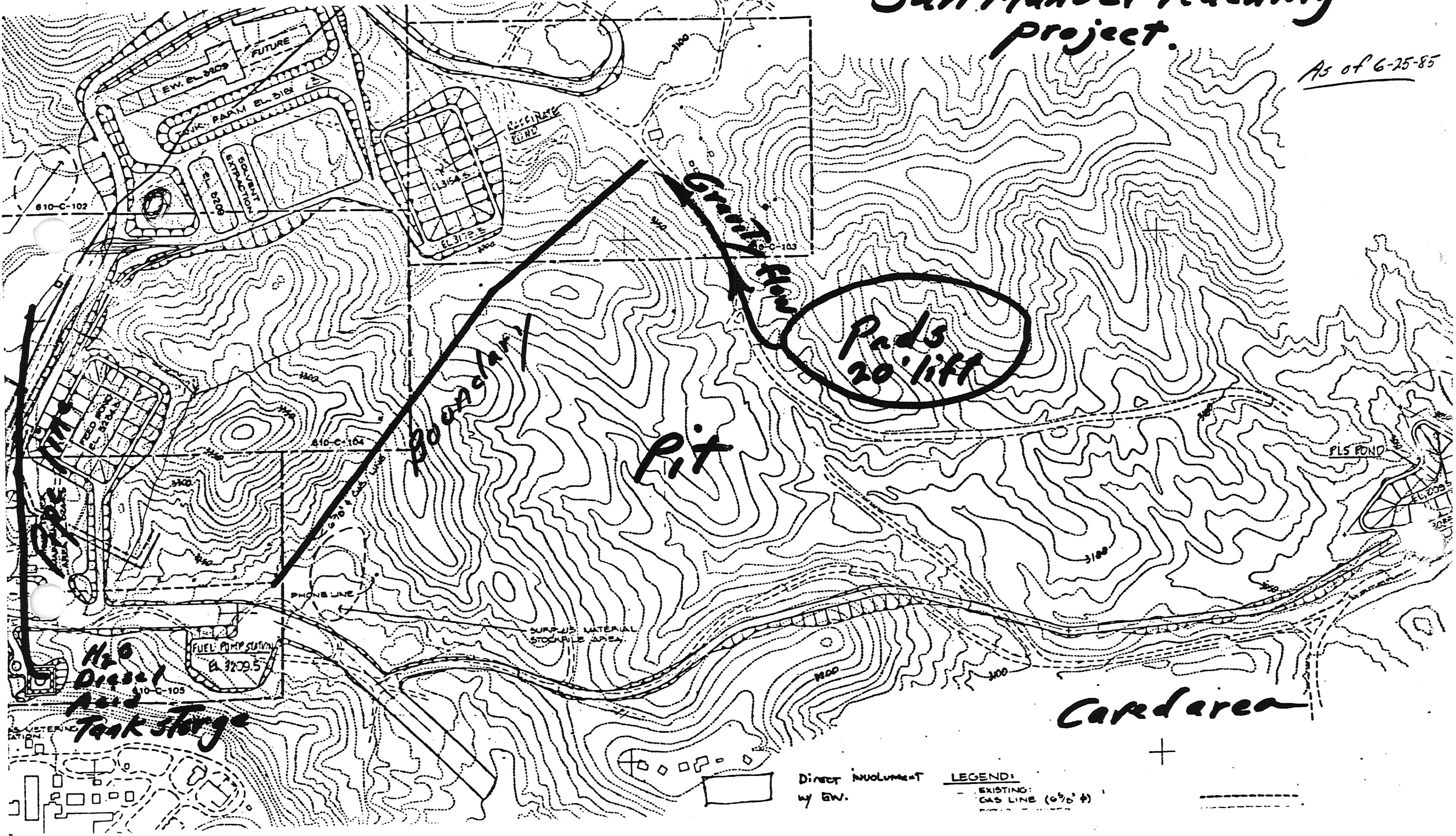


FIG.1

PLAN OF SAN MANUEL PROSPECT

SHOWING

DRILLING GRID, CHURN DRILL HOLES AND AREAL GEOLOGY

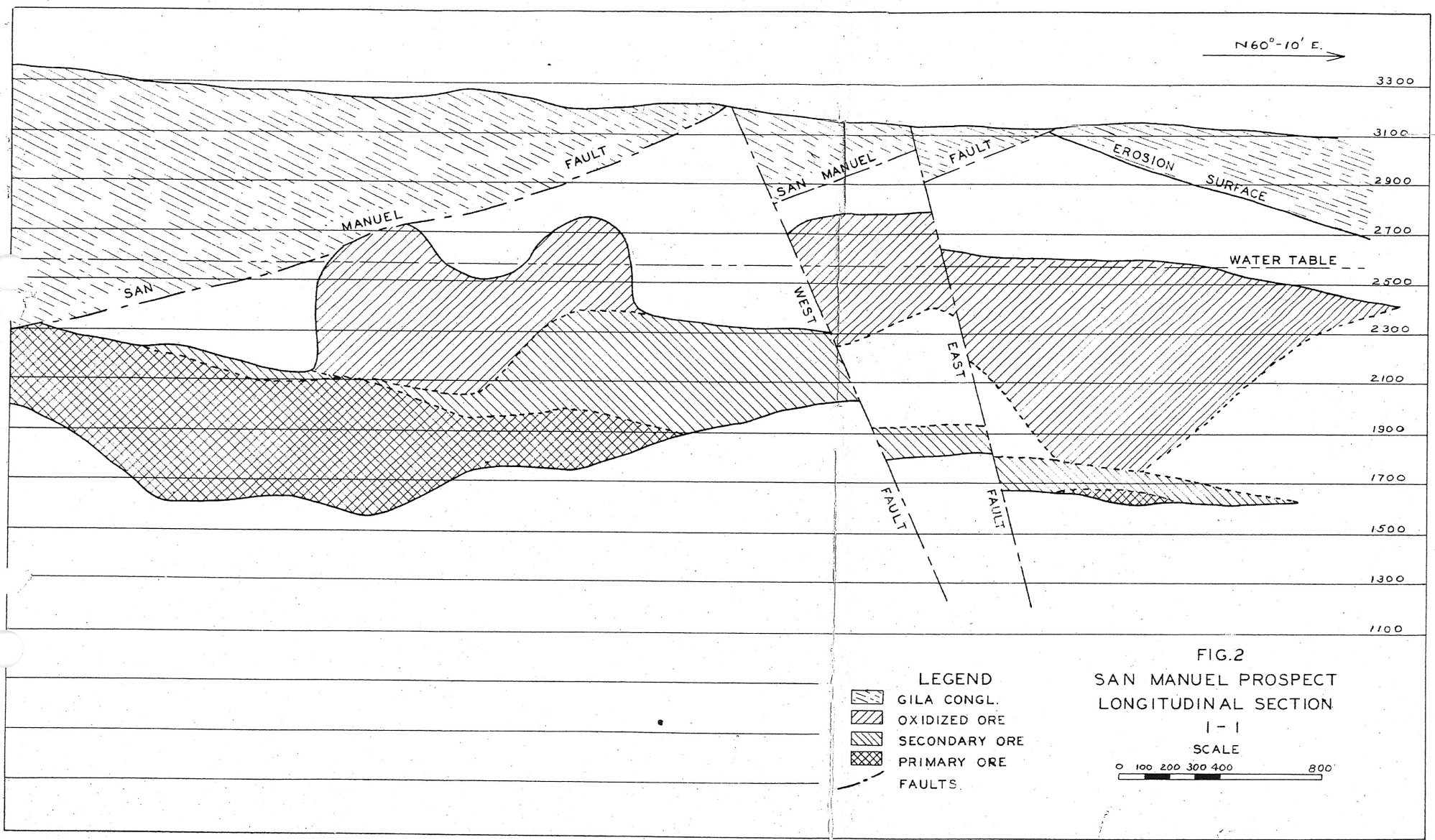
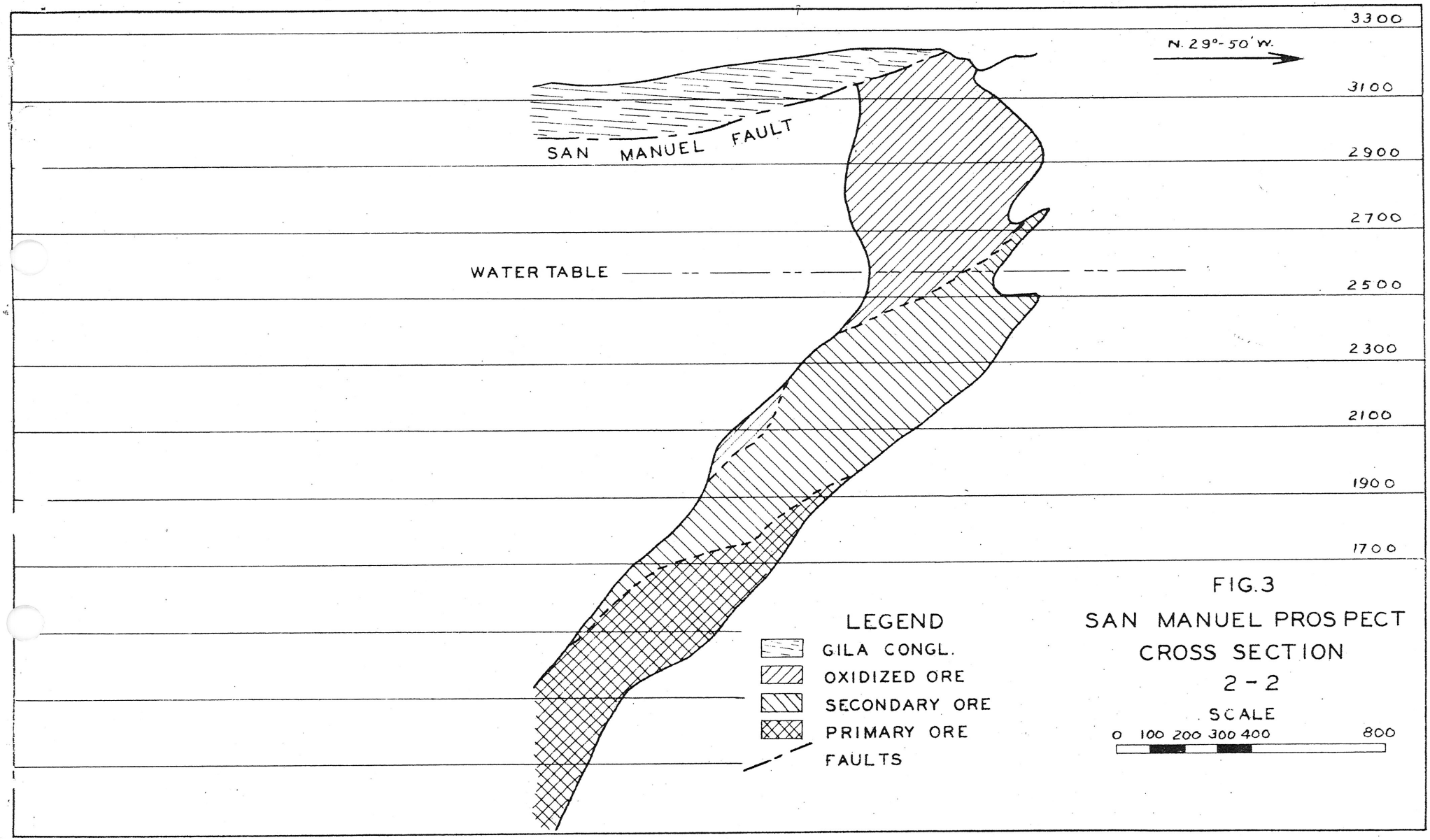
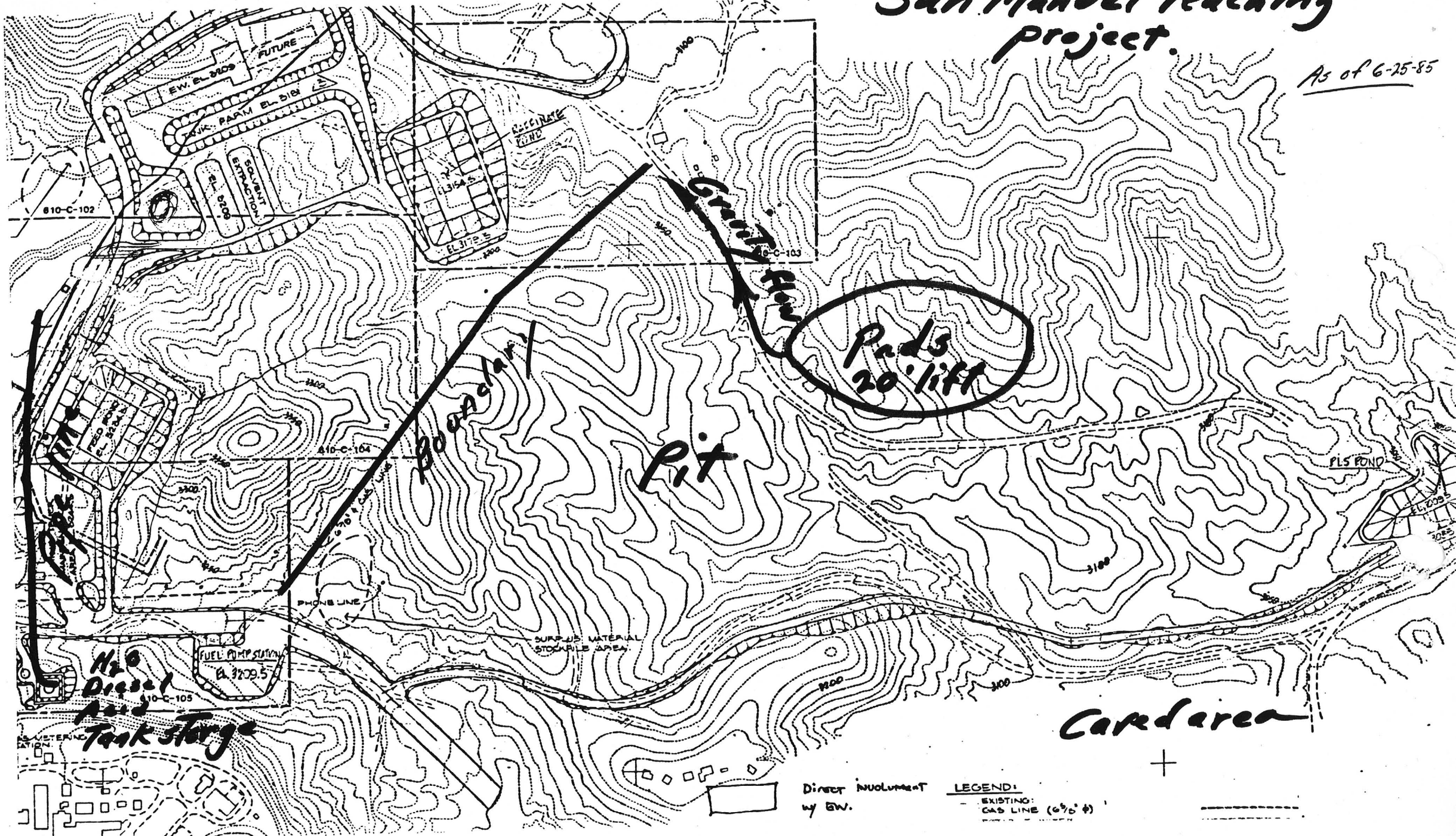


FIG.2
SAN MANUEL PROSPECT
LONGITUDINAL SECTION
I - I
SCALE


3300
3100
2900
2700
2500
2300
2100
1900
1700
N. 29°-50' W.
SAN MANUEL FAULT
WATER TABLE
LEGEND
GILA CONGL.
OXIDIZED ORE
SECONDARY ORE
PRIMARY ORE
FAULTS
FIG. 3
SAN MANUEL PROSPECT
CROSS SECTION
2 - 2
SCALE
0 100 200 300 400 800


San Manuel leaching project.
As of 6-25-85
EW. EL. 3109
FUTURE
TANK FARM EL. 3104
SOLVENT EXTRACTION
EL. 3109
RAFFINATE POND
EL. 3154.5
810-C-102
810-C-103
810-C-104
810-C-105
Gravity flow
Pads 20' lift
Boundary
Pit
RED POND EL. 3134
PLS POND
EL. 3095
670' GAS LINE
PHONE LINE
SURPLUS MATERIAL STOCKPILE AREA
FUEL PUMP STATION EL. 3109.5
H2O
Diesel
Fuel
Tank Farm
SWITCHING STATION
Canada area
Direct involvement by EW.
LEGEND:
EXISTING:
GAS LINE (6 5/8" ϕ)

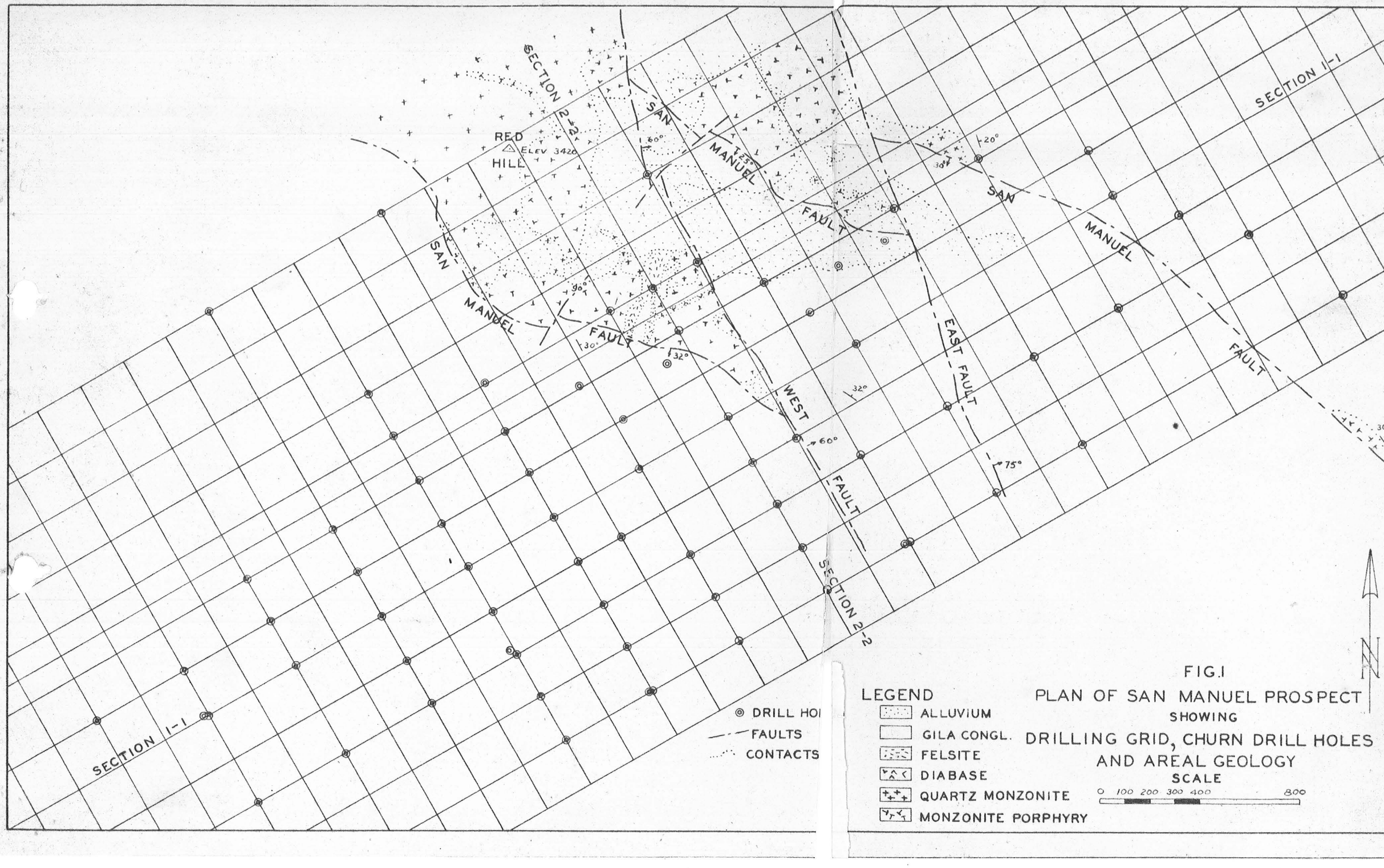


FIG.1

PLAN OF SAN MANUEL PROSPECT

SHOWING

DRILLING GRID, CHURN DRILL HOLES AND AREAL GEOLOGY

SCALE

SECTION 2-2

RED HILL
ELEV 3420

SAN MANUEL FAULT

SAN MANUEL FAULT

SAN MANUEL FAULT

EAST FAULT

WEST FAULT

SECTION 1-1

SECTION 1-1

SECTION 2-2

60°
75°
90°
30°
32°
20°
30°

N

LEGEND

- DRILL HOLES
- FAULTS
- CONTACTS

- ALLUVIUM
- GILA CONGL.
- FELSITE
- DIABASE
- QUARTZ MONZONITE
- MONZONITE PORPHYRY

FIG.1

PLAN OF SAN MANUEL PROSPECT
SHOWING
DRILLING GRID, CHURN DRILL HOLES
AND AREAL GEOLOGY

SCALE
0 100 200 300 400 800

N60°-10' E.

3300
3100
2900
2700
2500
2300
2100
1900
1700
1500
1300
1100

FAULT
SAN MANUEL
FAULT
EROSION SURFACE
MANUEL
SAN
WATER TABLE
WEST
EAST
FAULT
FAULT

LEGEND
GILA CONGL.
OXIDIZED ORE
SECONDARY ORE
PRIMARY ORE
FAULTS.

FIG.2
SAN MANUEL PROSPECT
LONGITUDINAL SECTION
1 - 1
SCALE
0 100 200 300 400 800'

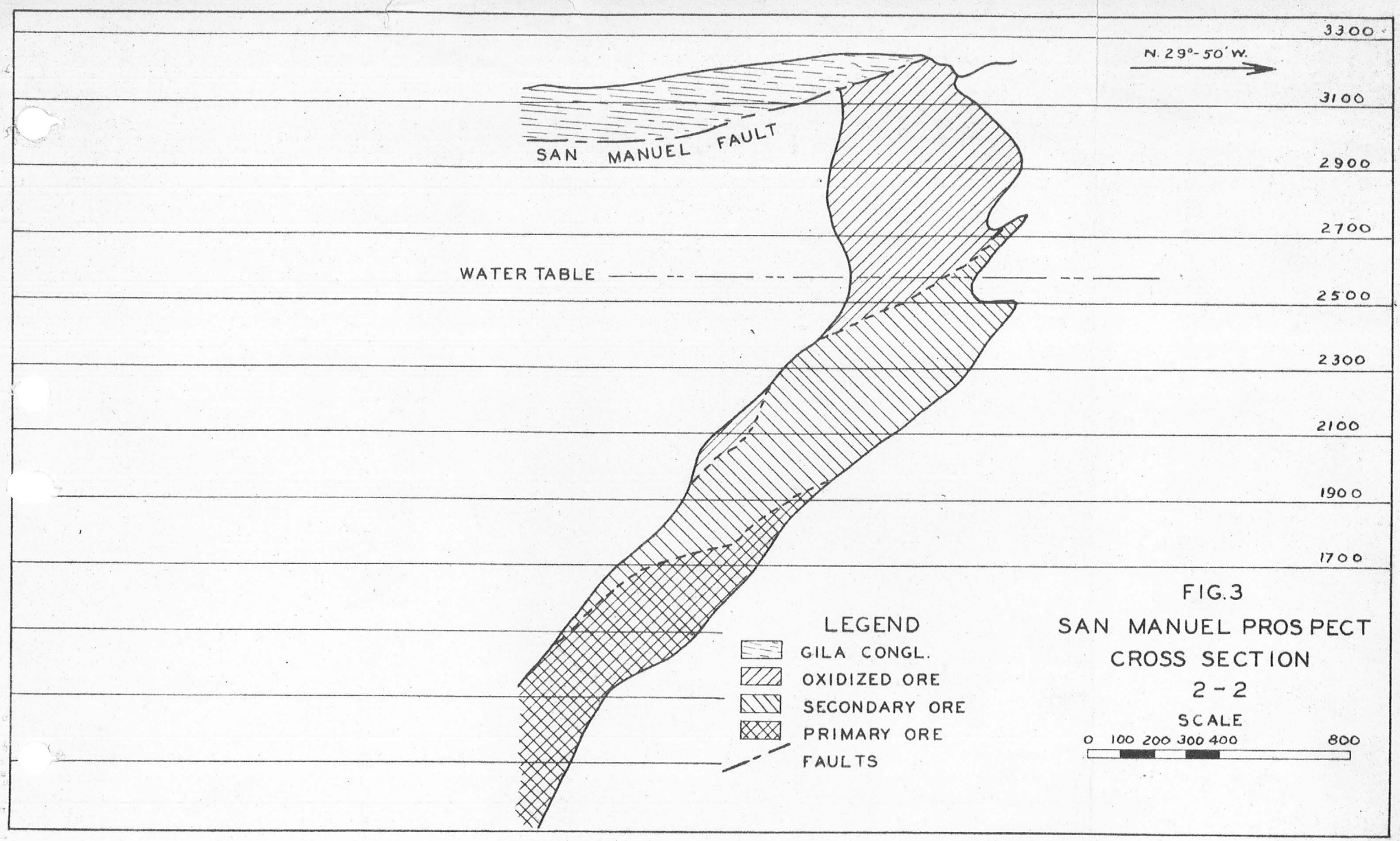
N.60°-10' E.

3300
3100
2900
2700
2500
2300
2100
1900
1700
1500
1300
1100

FAULT
MANUEL
SAN
SAN MANUEL
FAULT
EROSION SURFACE
WATER TABLE
WEST
EAST
FAULT
FAULT

LEGEND
GILA CONGL.
OXIDIZED ORE
SECONDARY ORE
PRIMARY ORE
FAULTS

FIG.2
SAN MANUEL PROSPECT
LONGITUDINAL SECTION
1 - 1
SCALE
0 100 200 300 400 800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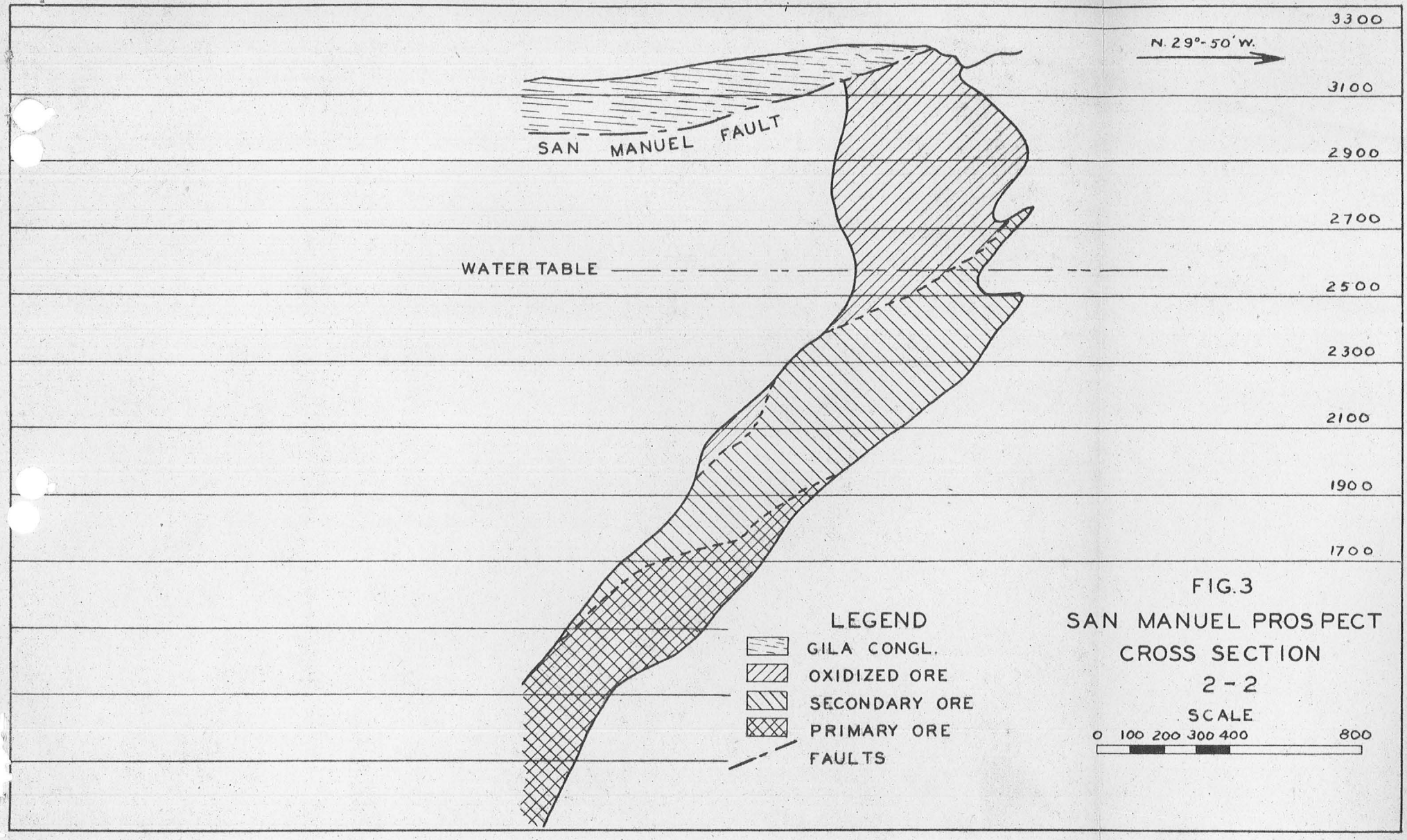
N. 29°-50' W.
SAN MANUEL FAULT
WATER TABLE
LEGEND
GILA CONGL.
OXIDIZED ORE
SECONDARY ORE
PRIMARY ORE
FAULTS
FIG.3
SAN MANUEL PROSPECT
CROSS SECTION
2-2
SCALE
0 100 200 300 400 800


3300
3100
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2300
2100
1900
1700
N. 29°-50' W.
SAN MANUEL FAULT
WATER TABLE
LEGEND
GILA CONGL.
OXIDIZED ORE
SECONDARY ORE
PRIMARY ORE
FAULTS
FIG.3
SAN MANUEL PROSPECT
CROSS SECTION
2 - 2
SCALE
0 100 200 300 400 800


SECTION 2-2
RED HILL
ELEV 3420
SAN MANUEL FAULT
SAN MANUEL FAULT
WEST FAULT
EAST FAULT
SAN MANUEL FAULT
SECTION 1-1
SECTION 2-2
60°
25°
30°
20°
90°
30°
32°
32°
60°
75°
30°
N

FIG.1

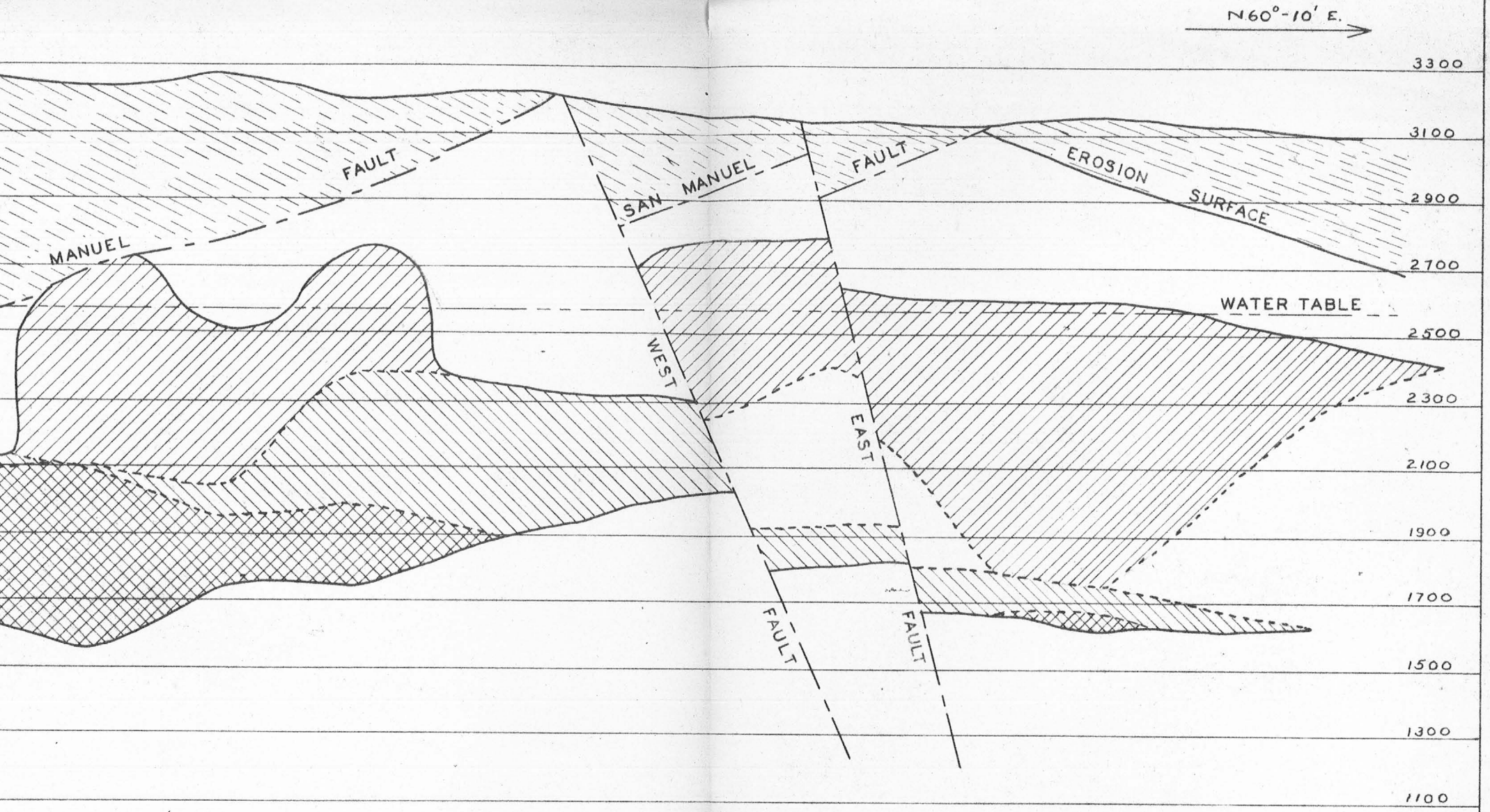


FIG.2

LEGEND

SAN MANUEL PROSPECT

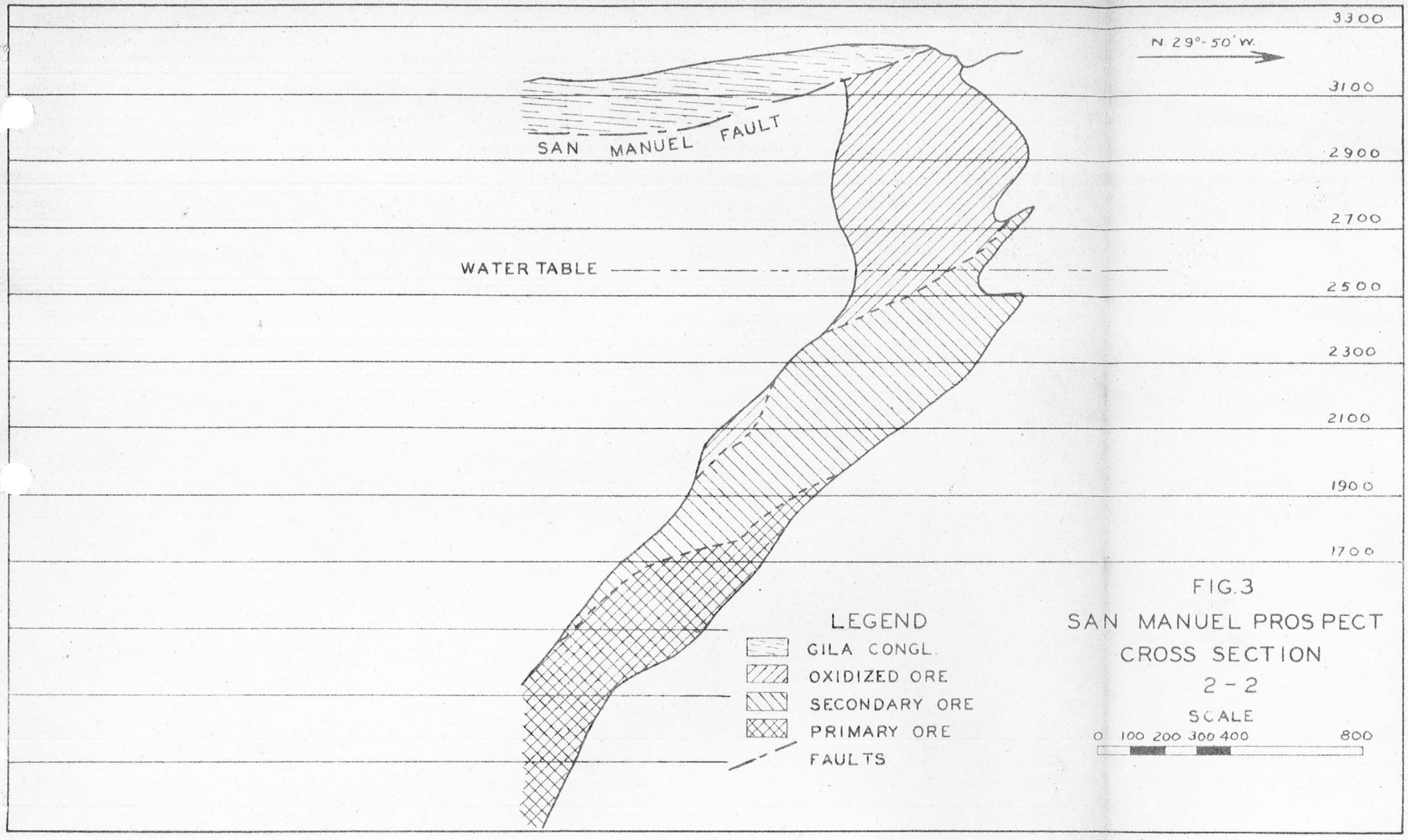
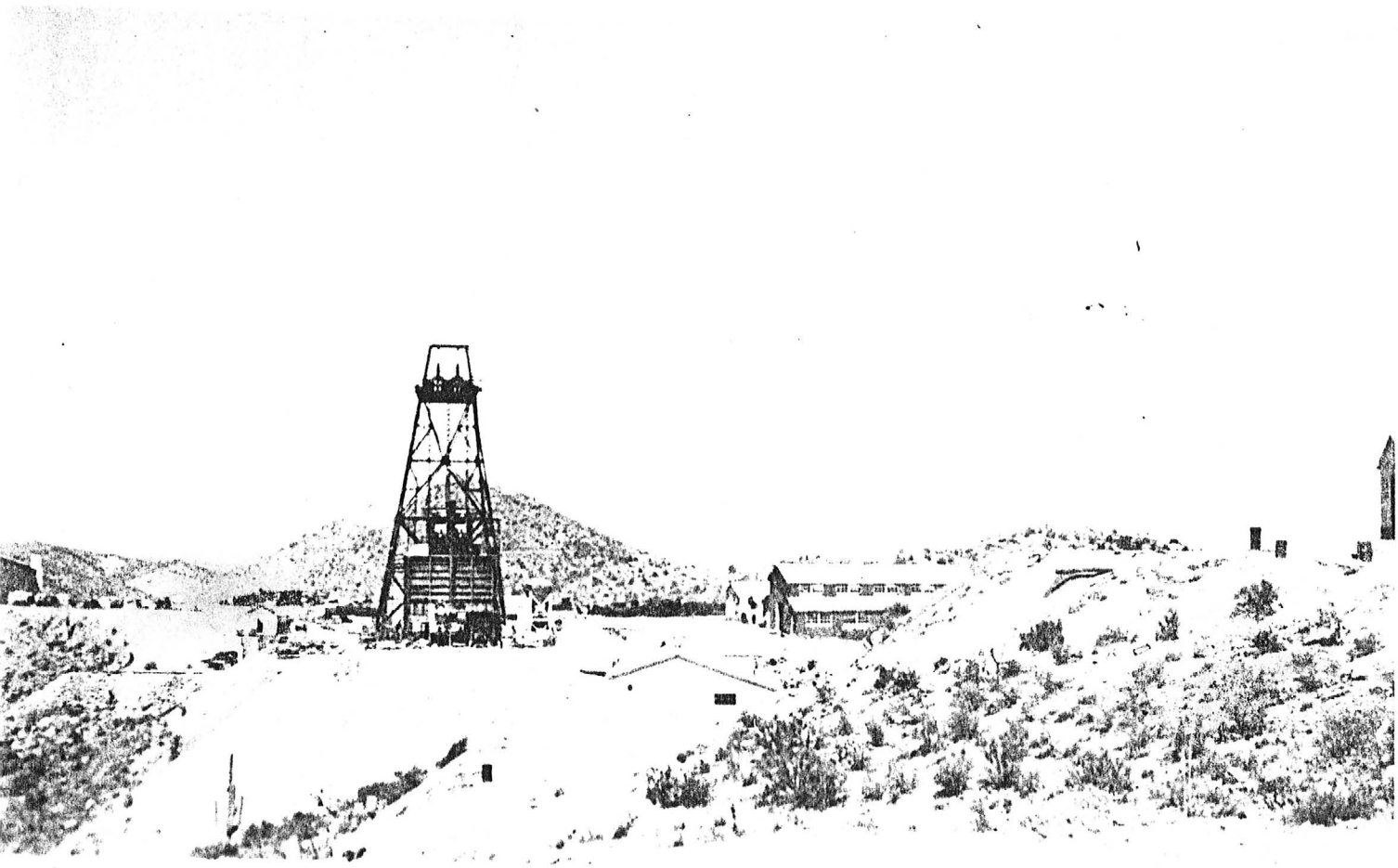


FIG. 3
SAN MANUEL PROSPECT
CROSS SECTION
2 - 2



A-182-1

C-1949


UTLX 12994
MAGMA
A SUBSIDIARY OF HEMMONT MINING CORPORATION
UTLX 12995

A-182-9

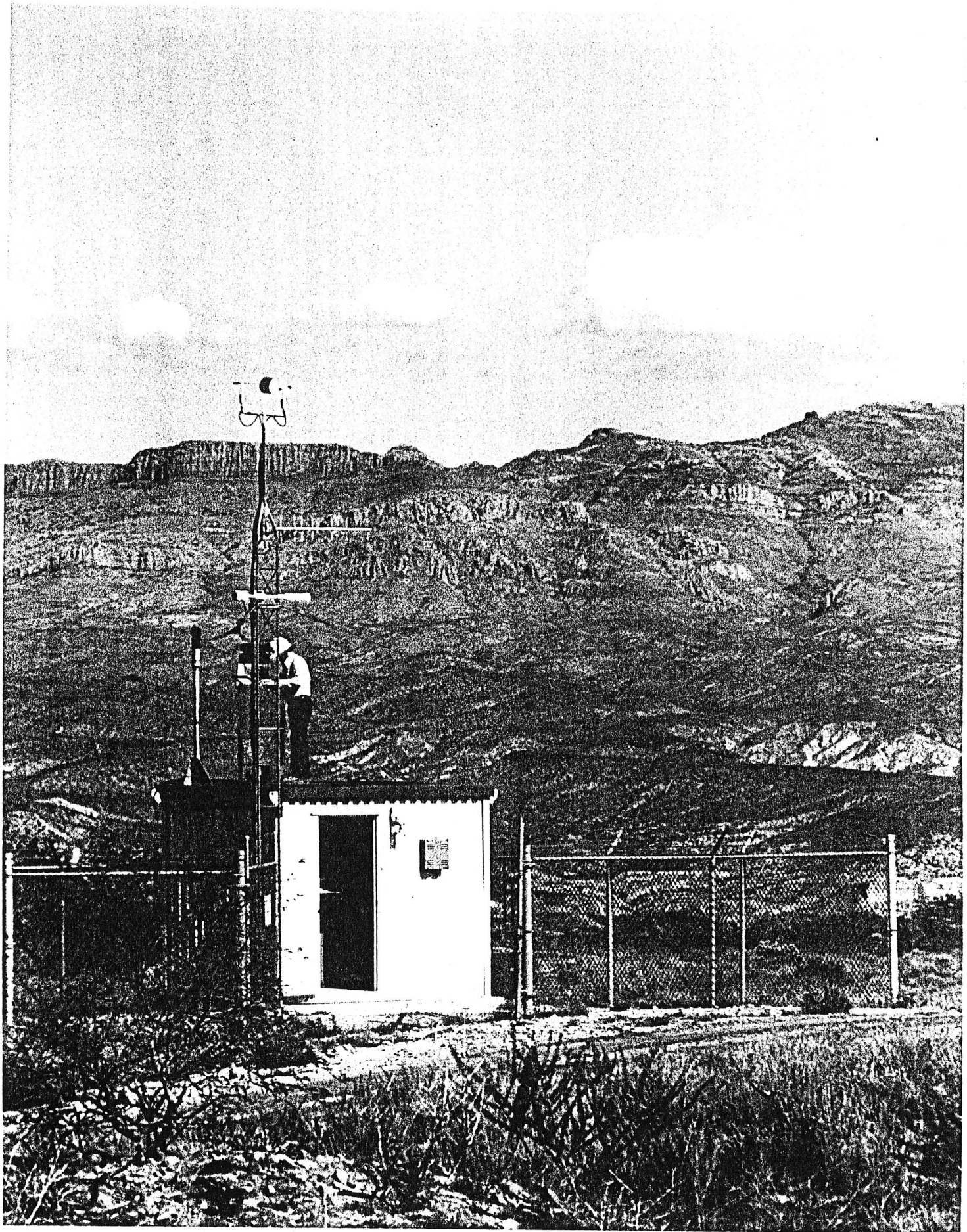
1972

LOADING sulfuric acid into 100 ton railroad tank cars at Magma Copper Company's San Manuel Division.

A-182-10

1992

HOISTING SHAFTS at Magma Copper Company's San Manuel mine are designed to lift 62,000 tons of ore per day from production levels as deep as 2,675 feet underground. At left of three headframes is smaller sinking headframe for fourth production shaft, and at right, sinking headframe for new service shaft for men and materials.

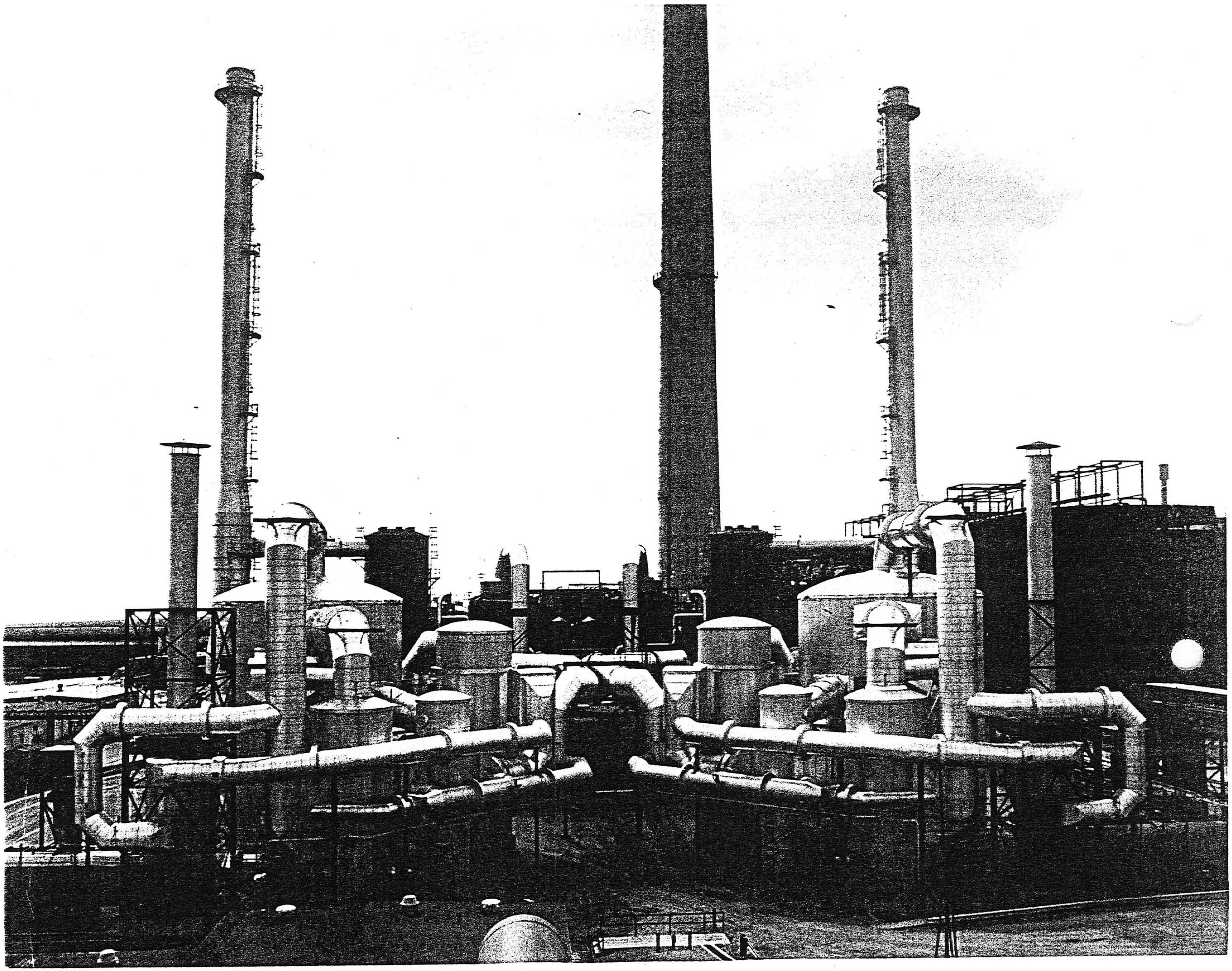


A-182-8

1972

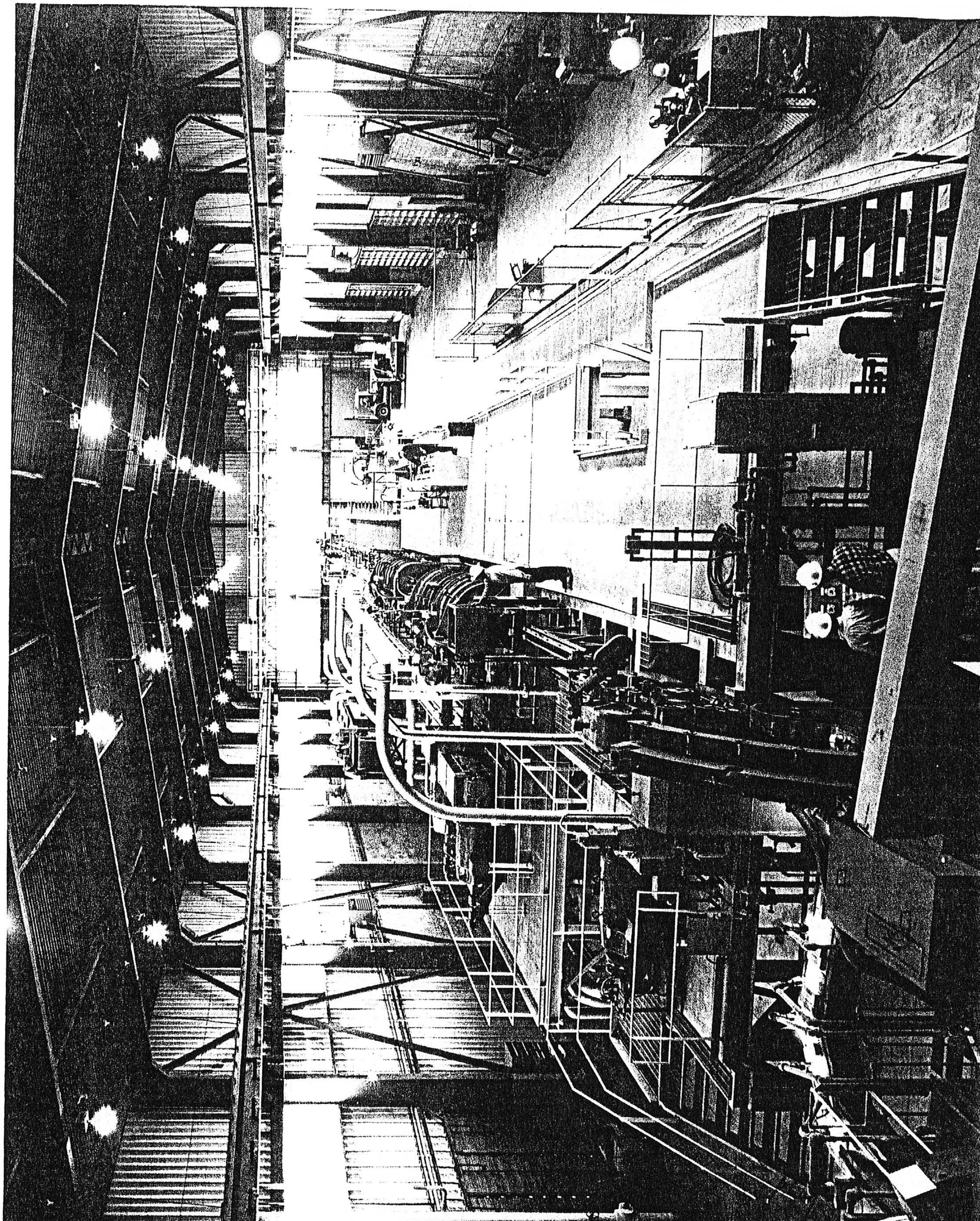
METEOROLOGIST works at one of eight air monitoring stations surrounding Magma Copper Company's smelter at San Manuel, Arizona. Stations continuously measure weather conditions and sulfur dioxide concentrations throughout area influenced by the smelter and give air quality status reports every three minutes to company officials.

6-281-11



1992

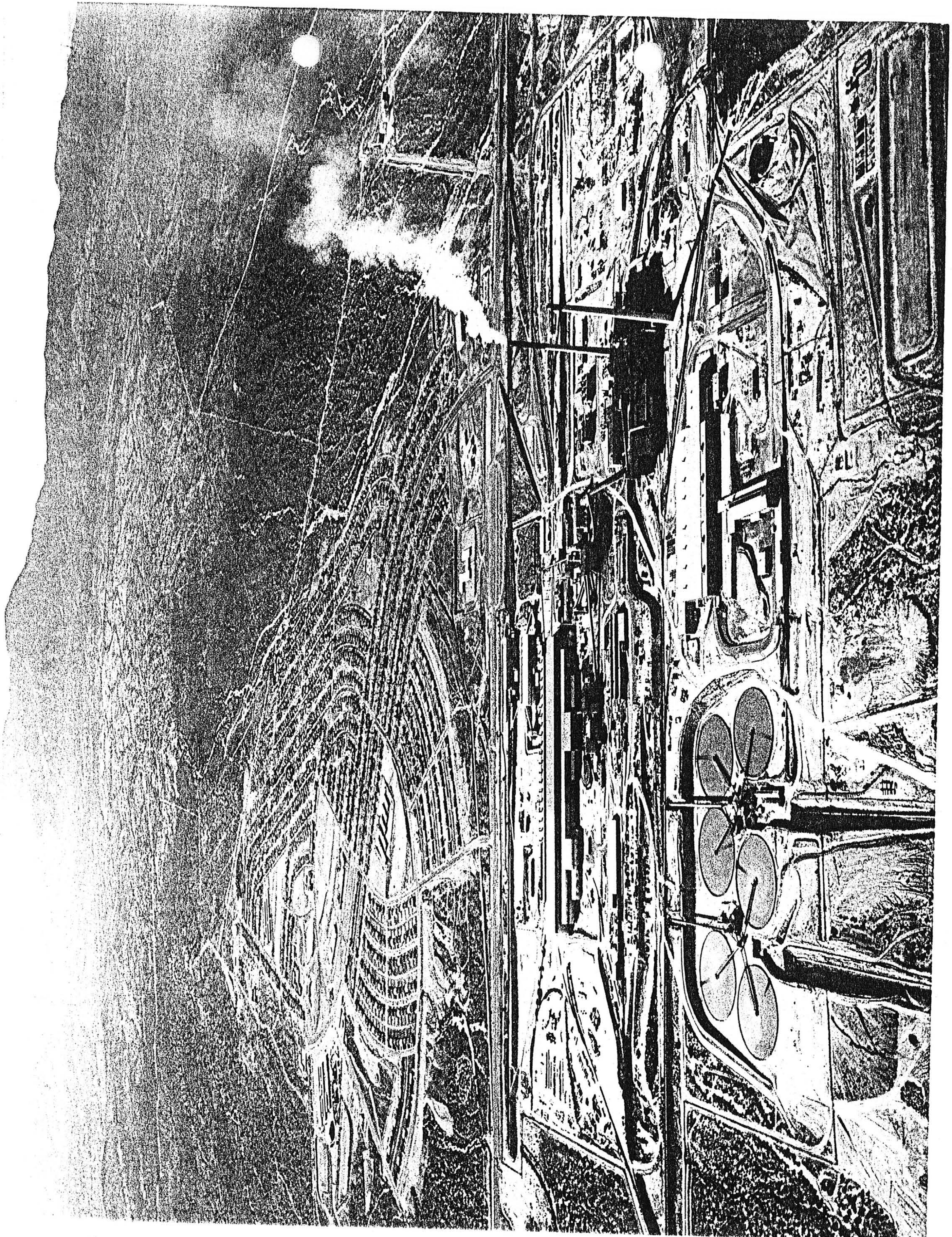
SULFURIC ACID PLANT, now in operation at Magma Copper Company's San Manuel, Arizona, smelter, recovers approximately 96% of the sulfur dioxide from the smelter converters and produces up to 2,000 tons of commercial grade sulfuric acid per day. Acid plant is part of $40 million air quality maintenance program at San Manuel.



A-182-6

1972

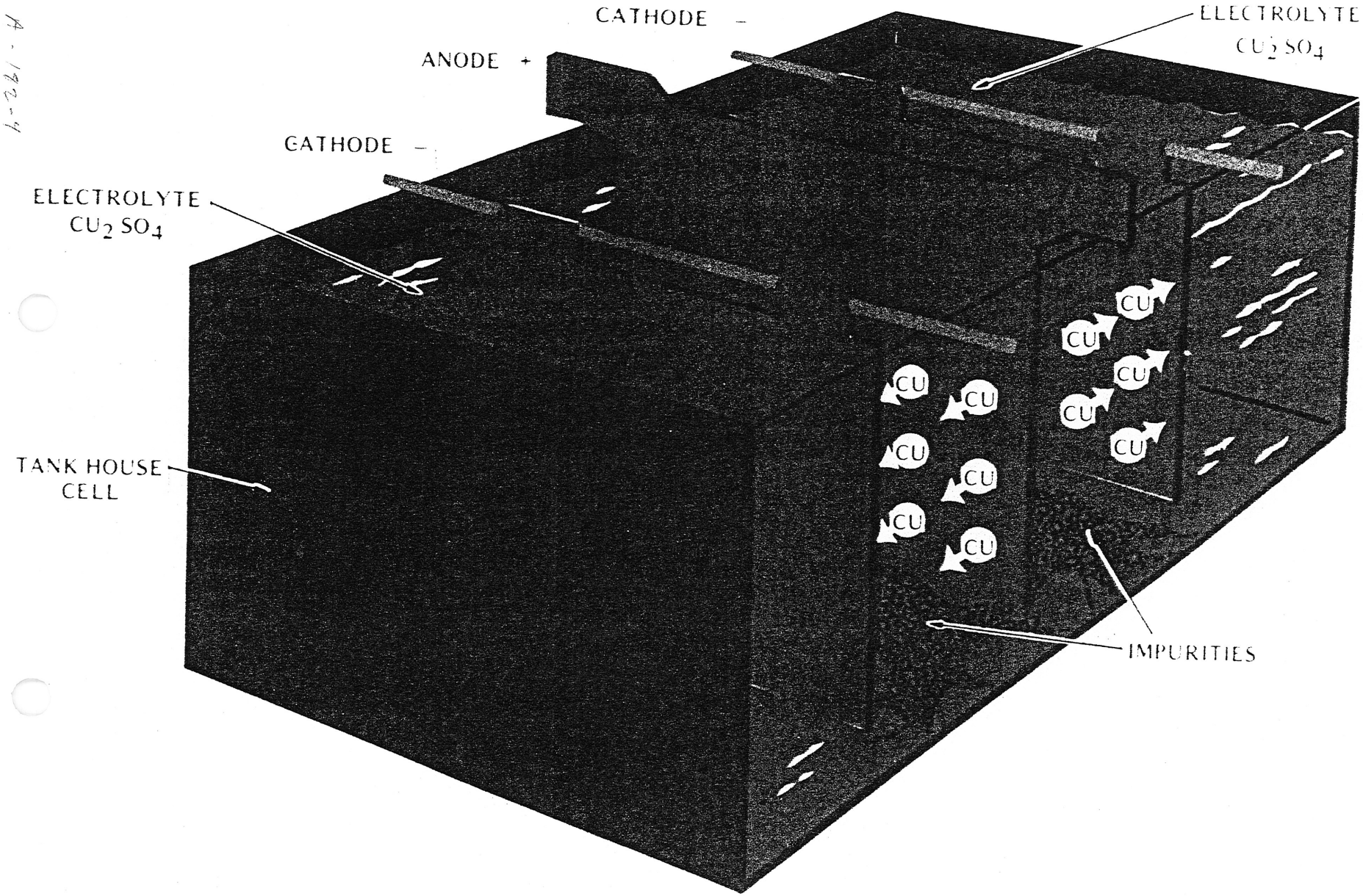
PRODUCTION OF CONTINUOUS COPPER ROD, 5/16" in diameter is performed by this 12 stand rolling mill at rates up to 4,000 feet per minute. The machine processes a 5-square-inch bar which is drawn and rolled progressively smaller, cleaned, pickled, waxed and coiled into packages weighing up to 16,000 pounds.



A-182-4

1972

EXPANDED FACILITIES at Magma Copper Company's production plant at San Manuel are: center, ore concentrator and smelter; lower right, electrolytic refinery; lower left, water reclamation system; upper center, San Manuel community with 1,276 homes. Plant processes 62,000 tons of ore per day and produces approximately 150,000 tons of copper per year.



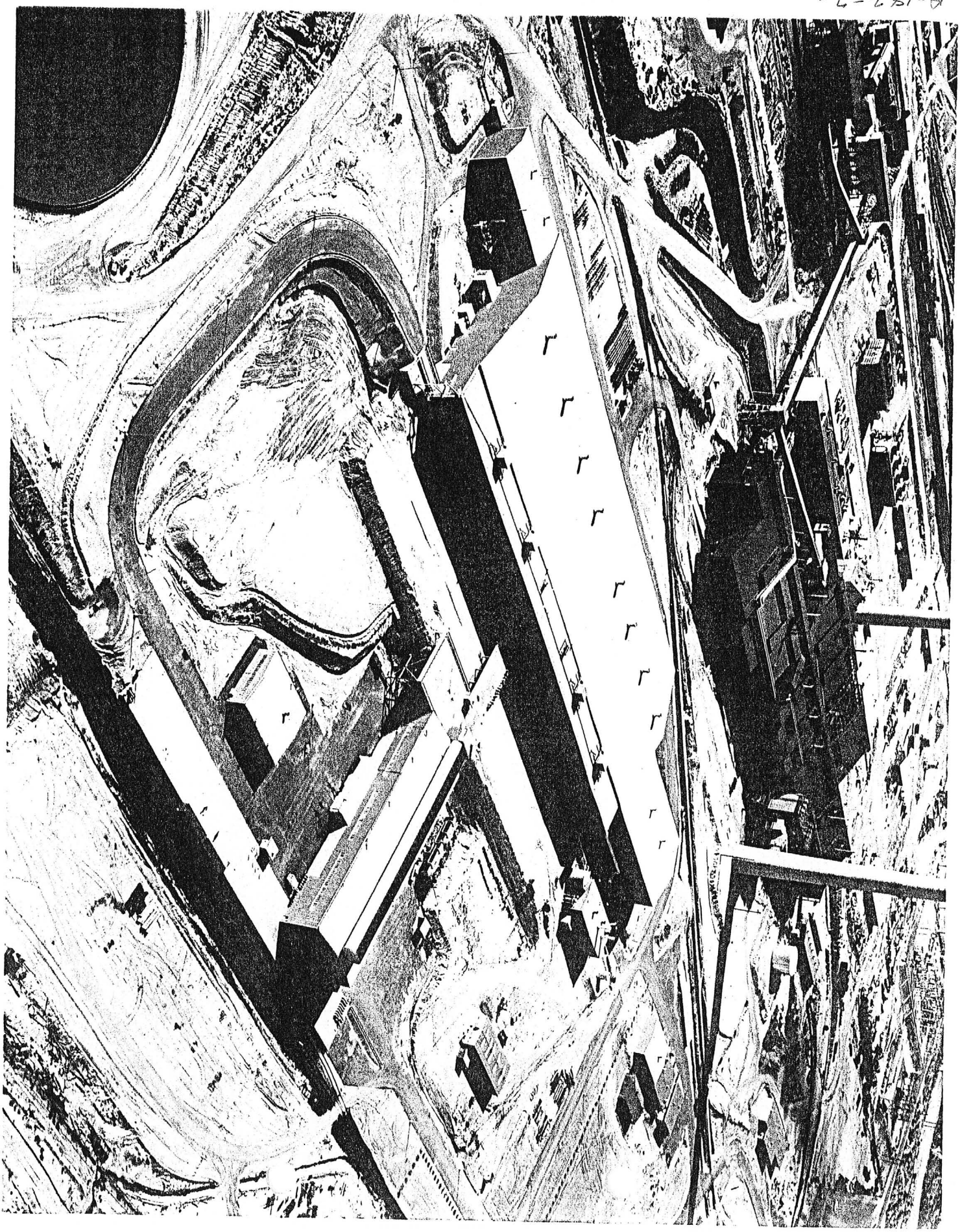
ONE ANODE PROVIDES TWO CATHODES IN 28-DAY CYCLE

ELECTRO DEPOSITION OF METALLIC COPPER IN ELECTRO REFINING PROCESS

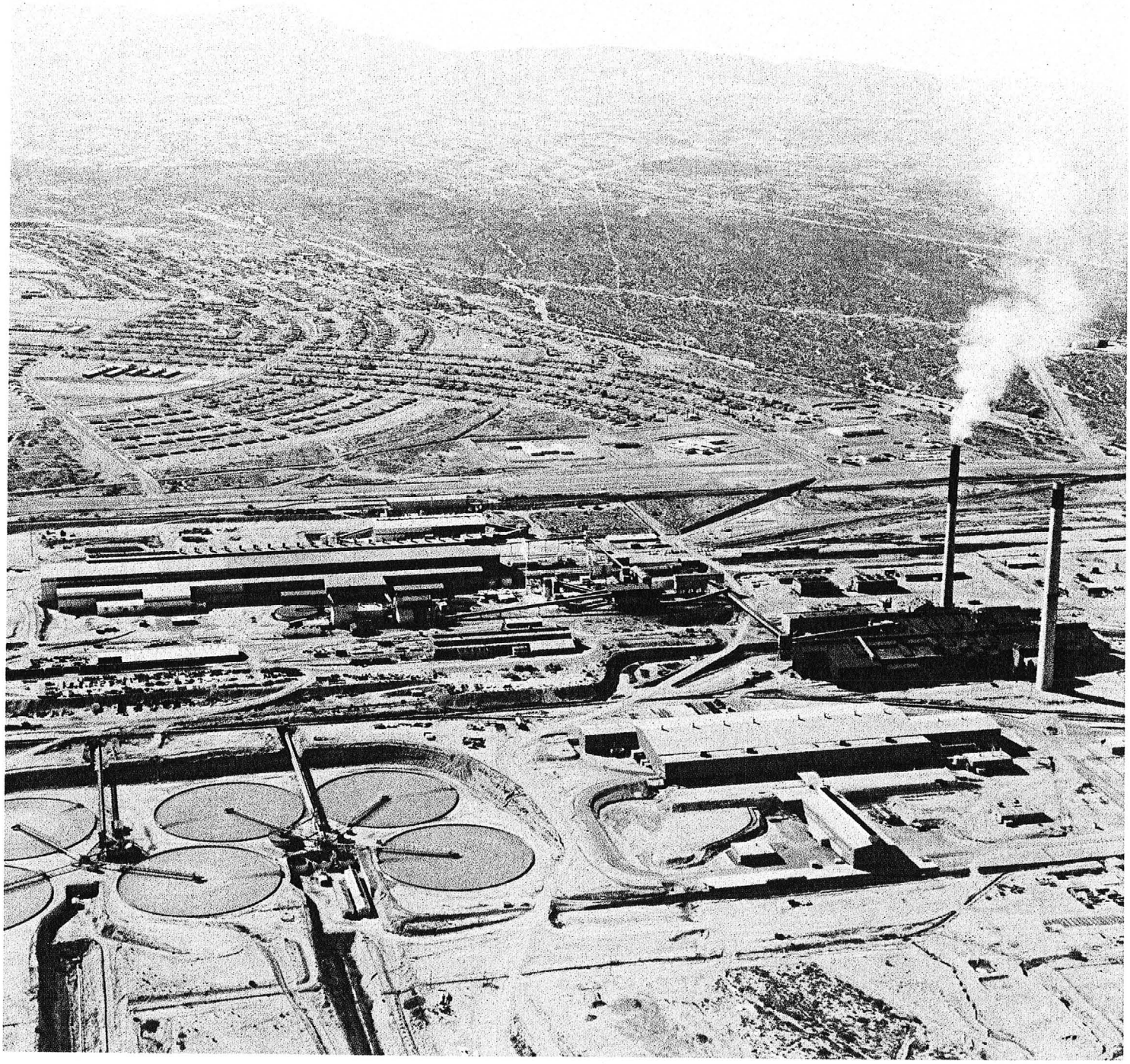
ELECTROLYTIC REFINING of copper takes place in Magma Copper Company's Refinery tankhouse at San Manuel. Crane hauls load of smelter anodes of copper to refining cells where electro-plating action transfers metallic copper from anode to a copper cathode sheet while impurities settle out. One 780 pound anode provides two 330 pound cathodes of pure copper ready to ship to market with remaining copper recycled.

2461

2-281-H

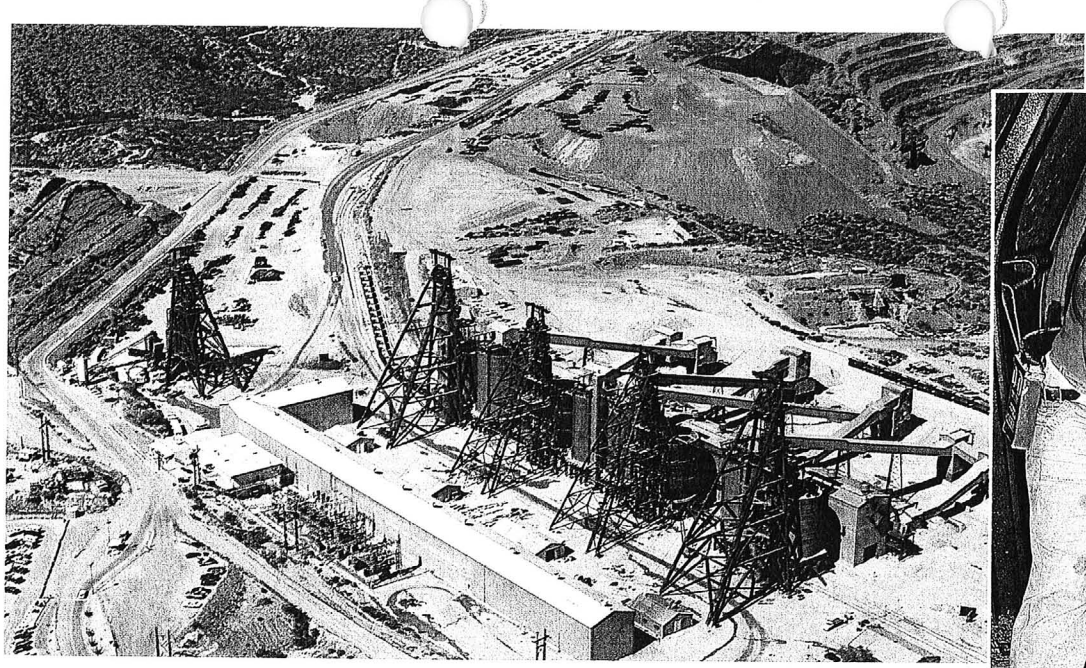


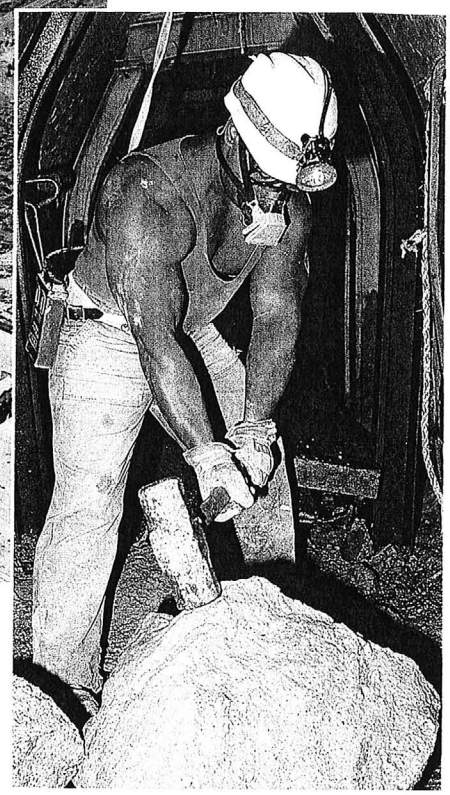
NEWEST ELECTROLYTIC REFINERY built in many years begins production in 1972 at Magma Copper Company's plant at San Manuel, Arizona. Tankhouse is adjacent to smelter to minimize handling of copper, as is location of casting house, loading docks and other facilities. Tankhouse has 179,333 square feet under roof while 16,500 cubic yards of concrete and 1,365 tons of steel were used in construction.



magma copper company
san manuel division

MAGMA





THE UNDERGROUND MINE

In production since 1956, the San Manuel mine has hoisted over 500 million tons of ore from a mineral deposit of approximately one billion tons of ore.

In terms of production capacity, size of the orebody, and installed facilities the San Manuel mine is a world class mineral enterprise.

The economic minerals are mined from an elliptical-shaped porphyry cylinder some 8,000 feet long and 2,500 feet across lying between 700 feet to 3,000 feet below the surface.

A faulted segment called the Kalamazoo, or "K" orebody, similar in size and composition, lies a mile to the west and between 2,500 and 4,000 feet below the surface.

Production from the San Manuel orebody is from zones of disseminated copper mineralization at an average grade of 0.65% (six and one half-tenths of one-percent)—or approximately 13 pounds of copper in each ton of ore.

Too deep for open pit mining, the orebody is recovered by the block caving method.

Block caving entails removal of a horizontal slice of ore so that the ore above will not support itself and will flow by gravity into and through a gathering system funneling into an underlying haulage level.

Ore is loaded by gravity into trains hauling 180 tons per trip to the dumps at vertical hoisting shafts where it is hoisted to the surface.

There are four production shafts, and three service shafts. The service shafts provide the intake ventilation and supply and the production shafts serve as exhaust ways. The forced air ventilation system provides up to 1,000,000 cubic feet per minute of fresh air circulating through the mine.

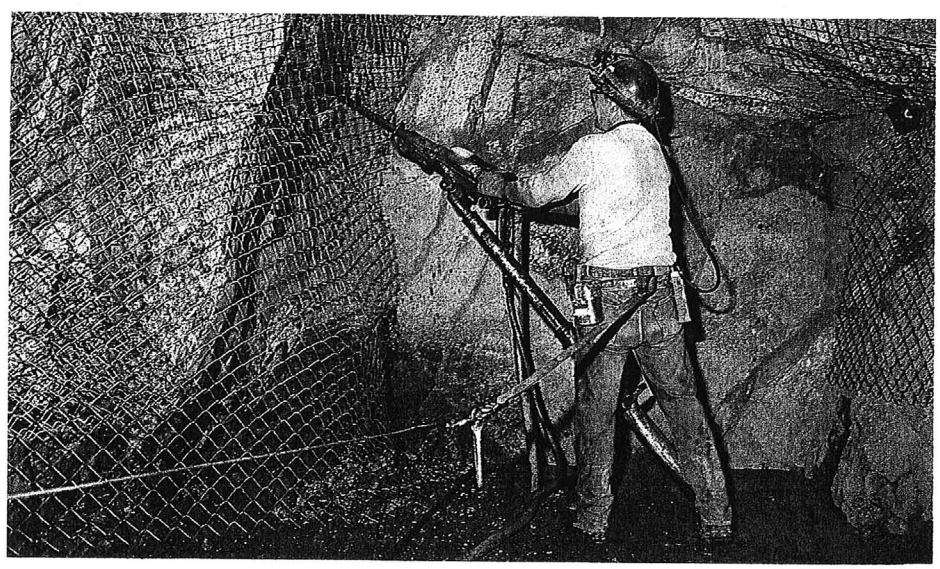
Primary development is performed with either rail mounted, pneumatic equipment or with trackless (rubber-tired) diesel equipment. Secondary development and undercutting use jackleg drills.

All openings are supported by either timber, concrete, or steel mesh and rock bolts.

Ore production requires a pair of levels separated from each other by 60 vertical feet. The upper draw level funnels muck through a system of transfer raises to the underlying haulage level.

Filling the transfer raises are employees on the draw level who pull ore from draw raises which reach up into the undercut zone of broken ore.

Thus the ore flows by gravity from the undercut 18 feet downward to the draw level and thence 60 feet down to the haulage. The caving system



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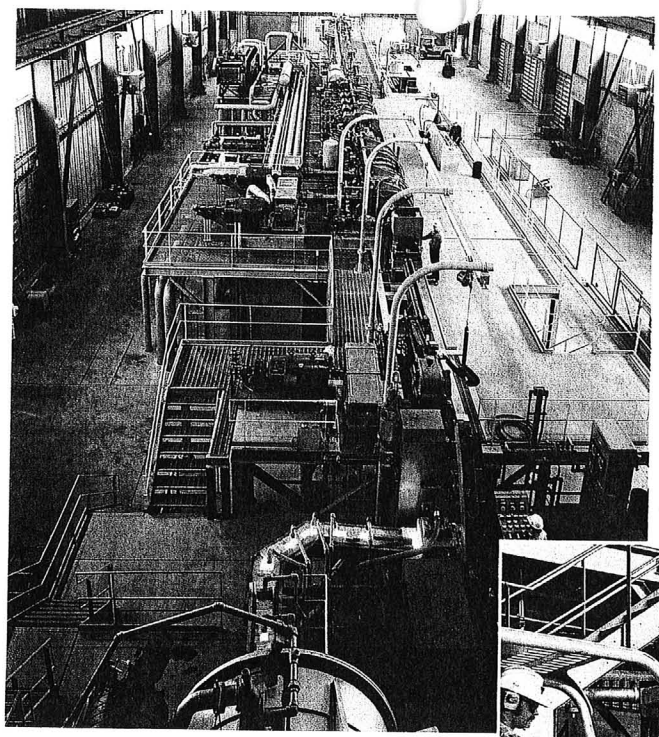
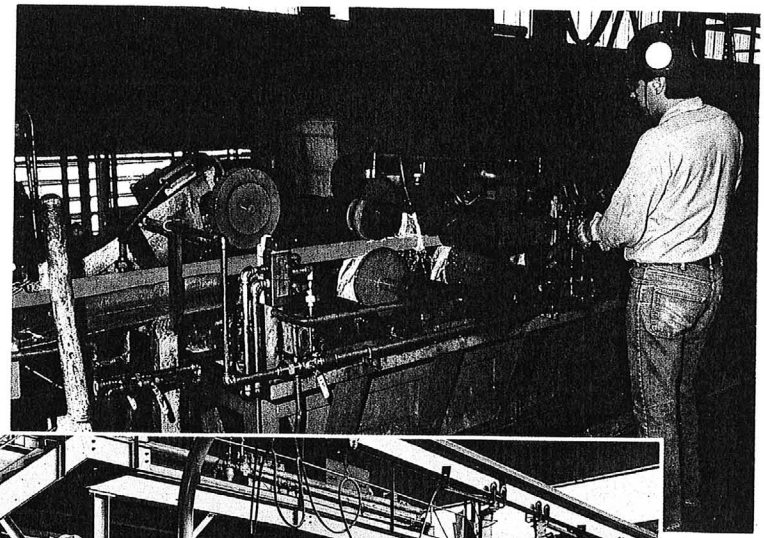
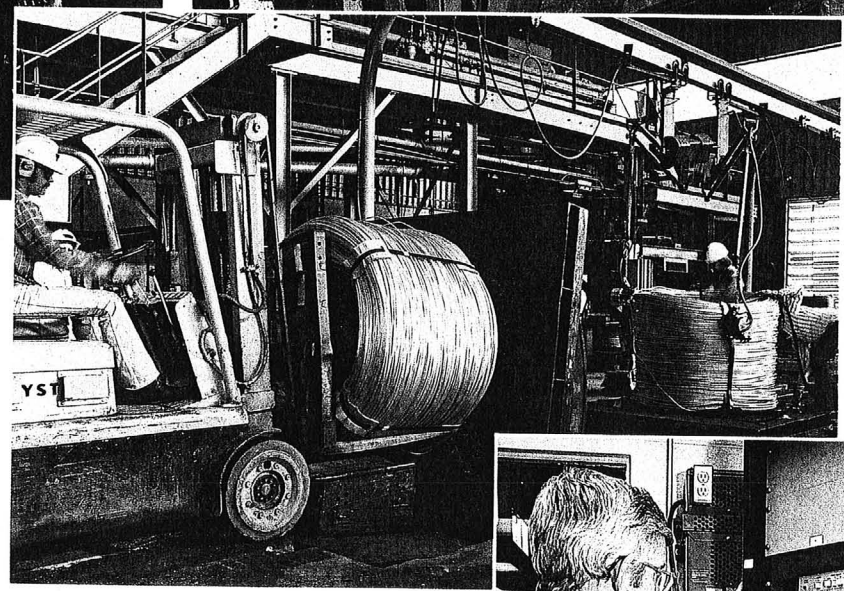






CONTINUOUS CAST COPPER ROD

Magma's principal product is premium quality continuous cast 5/16 inch wire rod, shipped to customers in the wire and cable industry in two standard shrink wrapped packages of either 4 or 8 ton laid coils, with other sizes available on request.

In addition, rod in other diameters such as .406", 9/16", or 3/4" can be produced on a custom basis.

Both the San Manuel and MCR-Chicago rod plants utilize the Southwire casting system and the 12-stand Morgan non twist rolling mill.

Cathodes from the electrolytic refinery and the San Manuel and Pinto Valley SX-EW plants are fed to a natural gas fired shaft furnace for melting and discharge to a holding furnace.

The molten copper is fed to an 8-foot diameter rotating vertical casting wheel at the rate of 36 to 40 tons per hour which produces a bar casting having six square inches of cross sectional area.

The bar continuously moves through the 12-stand rolling mill where it is sequentially reduced to the 5/16" diameter and then pickled, rinsed, waxed, and coiled.

The bar casting moves from the wheel at 58–62 feet per minute, then through the roughing and finishing mills and exits the coiler at 4,500 feet per minute.

The coils are banded, shrink wrapped, weighed and loaded directly onto rail cars or trucks for shipment.

A sample of each coil is subjected to rigid quality control tests before loading and shipment is permitted.

Rod Plant Data

Production capacity

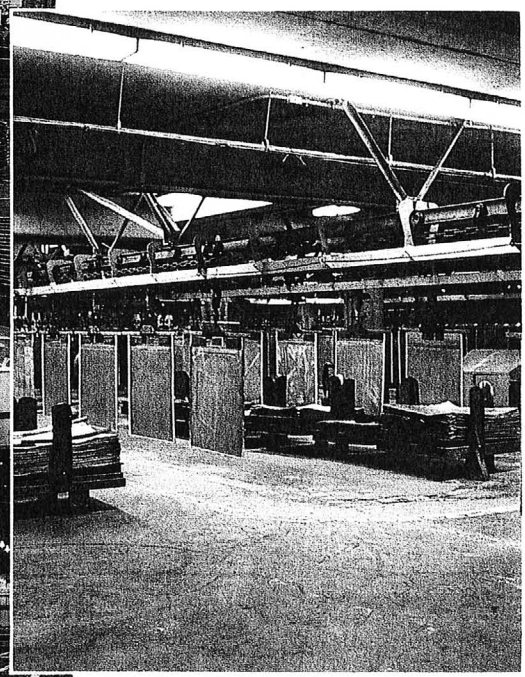
San Manuel	180,000 tons per year
MCR	140,000 tons per year

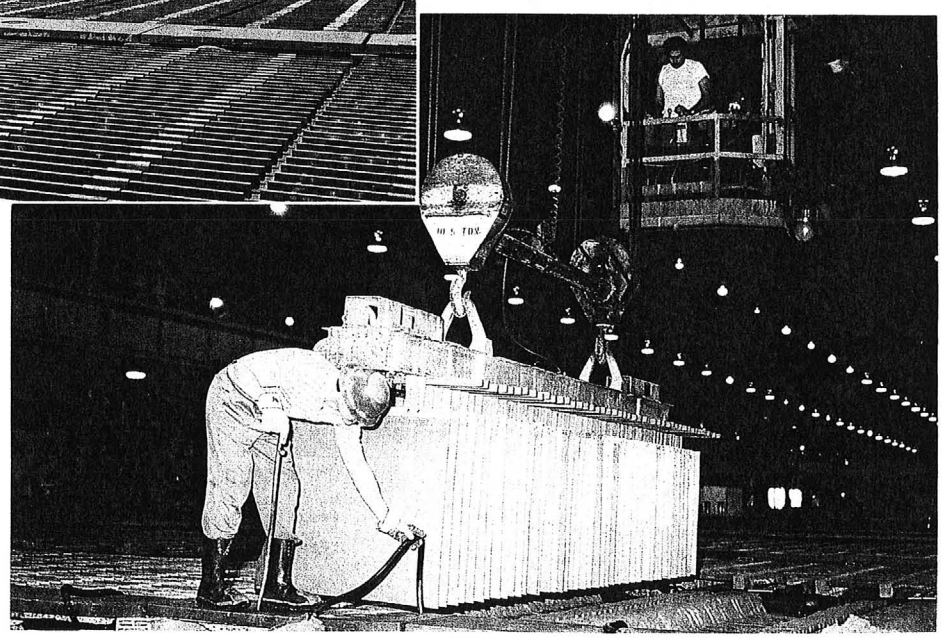
Employees

San Manuel	85
MCR	86

MAGMA

Magma Copper Company
P.O. Box M
San Manuel, AZ 85631
Telephone 602-385-3100





ELECTROLYTIC REFINING

In an electrolyte composed of sulfuric acid, copper sulfate, and plating reagents, copper is transferred from an anode at the positive pole of an electric circuit, to the cathode at the negative pole. The copper is plated at the cathode and impurities settle to the bottom of the refining cell.

At the San Manuel electrolytic refinery tankhouse there are 24 refining sections each with 42 lined concrete cells into each of which are suspended 46 anodes and 45 copper starting sheets.

Direct current at .250 volts and 29,000 amperes is applied to the electrodes. Plating at a current density of 33 amps per square foot for 10 days produces a 365 pound cathode.

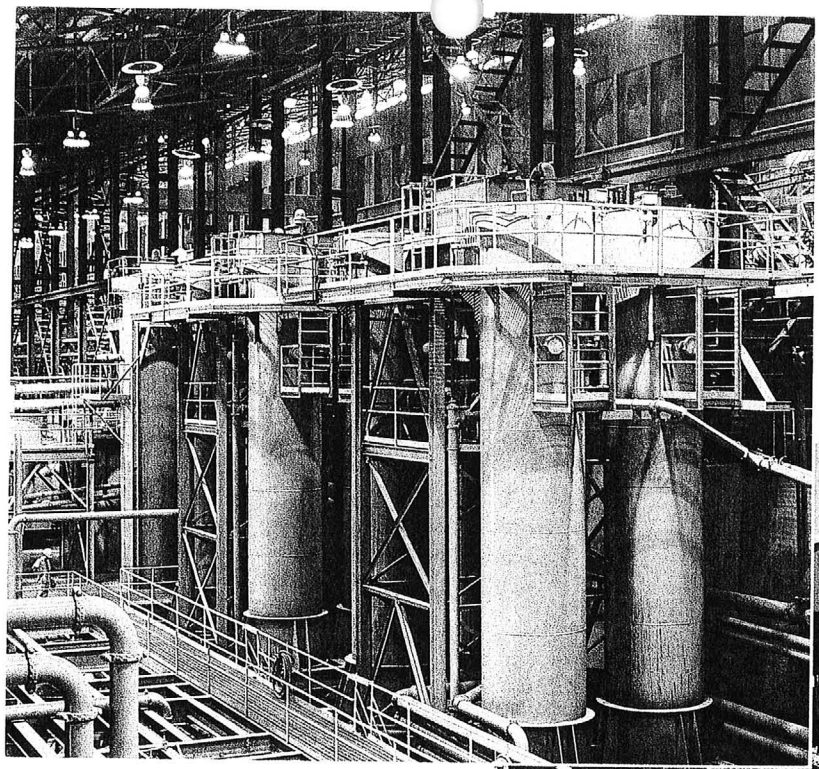
Starting sheets are produced in a 24-hour cycle and are plated on rolled copper mother blanks. The 13 pound starting sheets are finished and assembled mechanically at the rate of about 5,000 sheets per day.

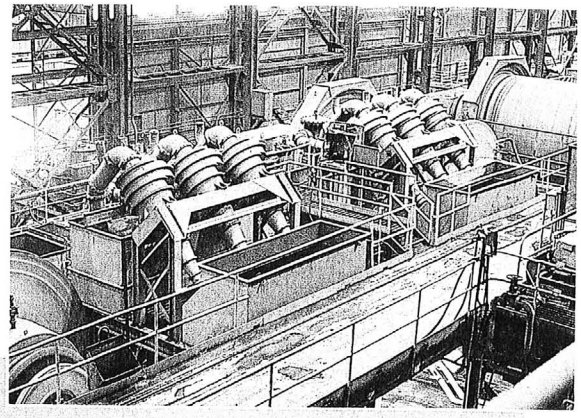
Settled residue from the refining process is collected and copper content recovered by leaching. The remaining residues containing precious metals are filtered, dried and packaged for shipment to the specialty markets.

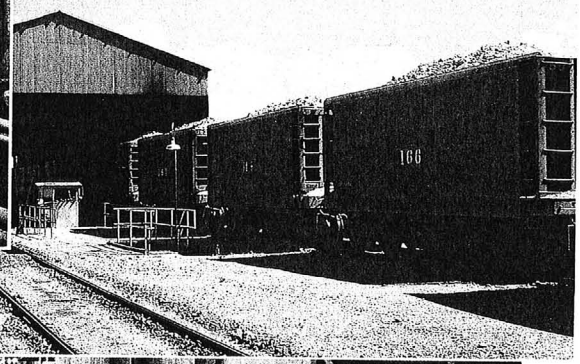
The Magma cathode is certified grade 1 by the London Metal Exchange and the New York Commodity Exchange and meets all quality standards for rod casting or direct sale to copper fabricators.

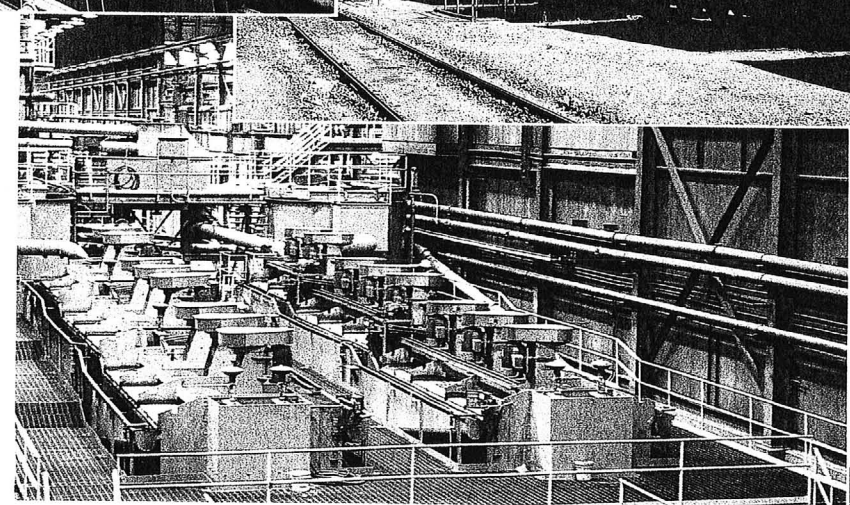
MAGMA

Magma Copper Company
P.O. Box M
San Manuel, AZ 85631
Telephone 602-385-3100









MILLING AT SAN MANUEL

Two crushing plants size the ore from the underground mine, first at the mine site with four 1,200 ton per hour gyratory crushers and then at the mill in two stages with 11 cone crushers.

Ore is transported from the primary crusher at the mine to the mill in a 40-unit ore train of 100 ton bottom dump cars pulled by a 1,600 hp diesel electric locomotive.

A modernized concentrator at San Manuel processes the ore production from the underground mine as well as slag from the smelter's flash furnace and converters.

The concentrator utilizes 13 wet grinding sections, each with one rod mill and two ball mills operated by digitally based programmable controllers.

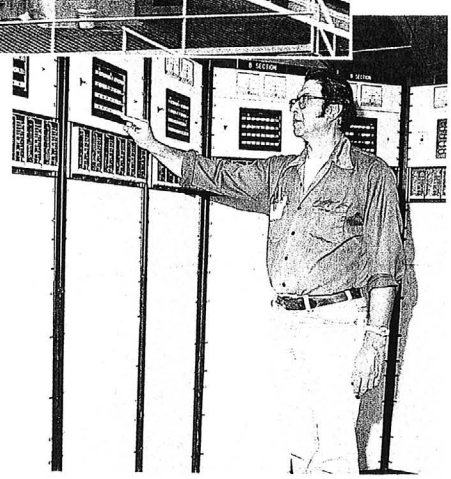
There are eight independent froth flotation sections. Rougher flotation occurs in ten 2,000 cubic foot and in one hundred forty three 300 cubic foot flotation machines. Flotation here is monitored by on-stream analyzers.

Cleaner flotation is performed in sixteen state-of-the-art column cells which are 39 feet high.

The product from froth flotation is thickened and pumped to the molybdenite plant where a flotation process recovers a molybdenum disulfide concentrate, a major by-product of San Manuel.

Tailings from the moly plant are the final copper concentrate which, after filtering and drying are transported by conveyor to the smelter.

Tailings from the copper plant are thickened and flow by gravity to the large tailings impoundments. All water from tailing dams and the thickeners is continuously recycled back into the milling process.



MAGMA

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MEETING OF THE PHOENIX COUNCIL ASMOA

March 17, 1959

MINERAL BUILDING, FAIRGROUNDS, PHOENIX, ARIZONA

Chairman Mackenzie called the meeting to order at 8:00 P.M. with 23 in attendance.

The minutes of the previous meeting were read and approved.

Mr. Mackenzie discussed the unfavorable implication of the proposed bill to establish a National Wilderness preservation system and called for a motion to name a representative of this Council to testify adversely at the hearing to be held by the sub-committee of the Senate Interior and Insular Affairs Committee.

Lewis Smith moved that Mr. Mackenzie be so designated and following seconding the motion was carried unanimously. Mr. Smith made additional comment upon the Wilderness Bill and its restrictive effect upon the natural resources industries of the nation and particularly upon the expanding economy of the western states.

Mr. Smith, as Program Chairman, introduced the speaker of the evening, Mr. Hugh Steele, Asst. Mine Supt. of the Magma Mine of Magma Copper Corporation. The subject of Mr. Steele's talk: "Mining Methods at Magma and San Manuel." Mr. Steele announced that he would confine himself principally to the Magma Mine since he had transferred from his position as assistant engineer for San Manuel over a year ago. Following is a brief summary of his talk.

The Magma Company was organized in 1910 and has operated the Magma Mine continuously since that time. The San Manuel Mine was acquired in 1944 and the project recently attained its production goal of 30,000 TPD.

The Magma vein strikes N 80°E, and to a depth of 800' dips north at 70°. It then is vertical to 1000', and from 1000' to the 4800' level which is the lowest working level in the mine the vein dips south 70°. No 5 shaft is currently sinking from 4800' to 4900' and the dip of the vein is becoming flatter (57 to 58°). The vein has been explored, and developed and mined, for a strike length of 9000'.

The east ore body was discovered some 6 or 7 years ago and it now accounts for approximately 60% of the mine's ore production. It is not an ore shoot along the vein but instead is a replacement in Devonian limestone under quartzite and extends 50 to 900' out into the beds away from the vein in both directions. The ore dips 30° west with the enclosing beds. Maximum thickness is 30 feet and average is 10 to 15 feet. The ore is mined by a modified long wall system which achieves an extraction of 95% or more of the ore. The level interval is 100' and 50' stope panels are carried upslope. Practically complete recovery of the pillars is realized. The greatest mining depth is 2900'. Exploration is now in progress on the 3400' and 3600' levels.

The stoping method is different in the west, the central and the east divisions of the mine.

In the west end of the mine the walls are chiefly Pinal schist which is rather incompetent and requires timber support. Shrinkage stoping was tried in the upper workings, but was not successful because of excessive dilution with waste from the walls. The method now in use is a square set cut and fill slot system (a modified form of the Mitchell slice system). The level interval is 200 feet and working raises are put up generally at 105' intervals along the strike of the vein. The usual stope length is 45'. Slots are cut across the full width of the veinfor3 sets in length on the vein. After a slot is carried up 3 or 4 floors a second slot is started and then a third slot when the second slot is 3 to 5 sets up and the first slot correspondingly higher. Fill is introduced when needed, usually when the first slot is up five floors, the second 3 floors and the third just beginning. Fill is derived principally from a glory hole in country rock. The glory hole is connected to the 4600' level by a raise and waste fill is drawn from the raise at various levels for use throughout the mine.

In the central division of the mine the walls are chiefly quartzite with some diabase. The walls here are more competent than in the schist area of the west end but not sufficiently firm to permit shrink stopes or stull timbering. The rock decrepitates especially when ventilation is poor. Mining in this central section is by rill stopes with floor slope of 20° and level intervals of 200'. Generally two incline cuts are taken between working raises and the ore slushed down slope. Then fill is placed and a floor of 2" x 10" lagging laid on the fill and another two cuts taken, etc. The walls and roof are controlled with bolts when needed. Where the ore widens to more than 12' or where looser than average ground is encountered square setting is resorted to. Also the rill stopes are finished at the top by square set method.

The mine was in its heyday, when mining was carried on in the depth interval 1800 to 2800'. The vein here reached widths up to 60' and some bornite stopes averaging 20 to 25% copper. For many years the ore has averaged 5½ to 6% Cu, above 2 oz. Ag and about .03 oz. Au. Currently 4 to 4½% Cu is considered the economical grade cut off and material of lesser grade is left in the mine.

There is no evidence to date of bottoming of the ore. The management believes that the depth limit will be determined by increased costs of mining rather than decline in grade of ore. Rock temperature on the 4800' level is 160°F and records indicate that a uniform increase of 1½° per 100' of depth is to be expected.

The Magma Mine and the San Manuel Mine offer a striking contrast in the types of ore deposit and method of mining. While both are underground mines Magma is a moderately high grade vein deposit and San Manuel is a very large low grade. (.80% Cu) porphyry deposit.

Unusual features of the San Manuel deposit are the great vertical thickness of ore and of the cap material, these being 1800' and 600' respectively. A Block

caving system is used and this is more or less conventional in most respects. However, because of the extreme thickness of the ore it will be caved in 3 vertical blocks each 600' thick. Mining of the upper third of the ore body is now in progress with the grizzly level laid out on the 1415' horizon. The first caving blocks were developed with very large areal dimension and they proved to be too large because of the excessive weight of ground to permit orderly control of caving. Present blocks are of smaller more manageable size. The original large blocks accomplished their prime purpose however which was to quickly initiate movement throughout the full thickness of the blocks.

Five main shafts were sunk: No. 1 for exploration and development and a twin shaft (No. 4) as a manway; No. 2 shaft, sunk in about the heart of the main ore body and served for planning and testing; the two twin shafts, A & B, were sunk on one end just outside the perimeter of the main ore body. These are the ore hoisting shafts.

The talk was followed by questions and comment from the floor ably monitored by Mr. Steele.

The meeting adjourned at 9:30 P.M.

Travis P. Lane, Secretary