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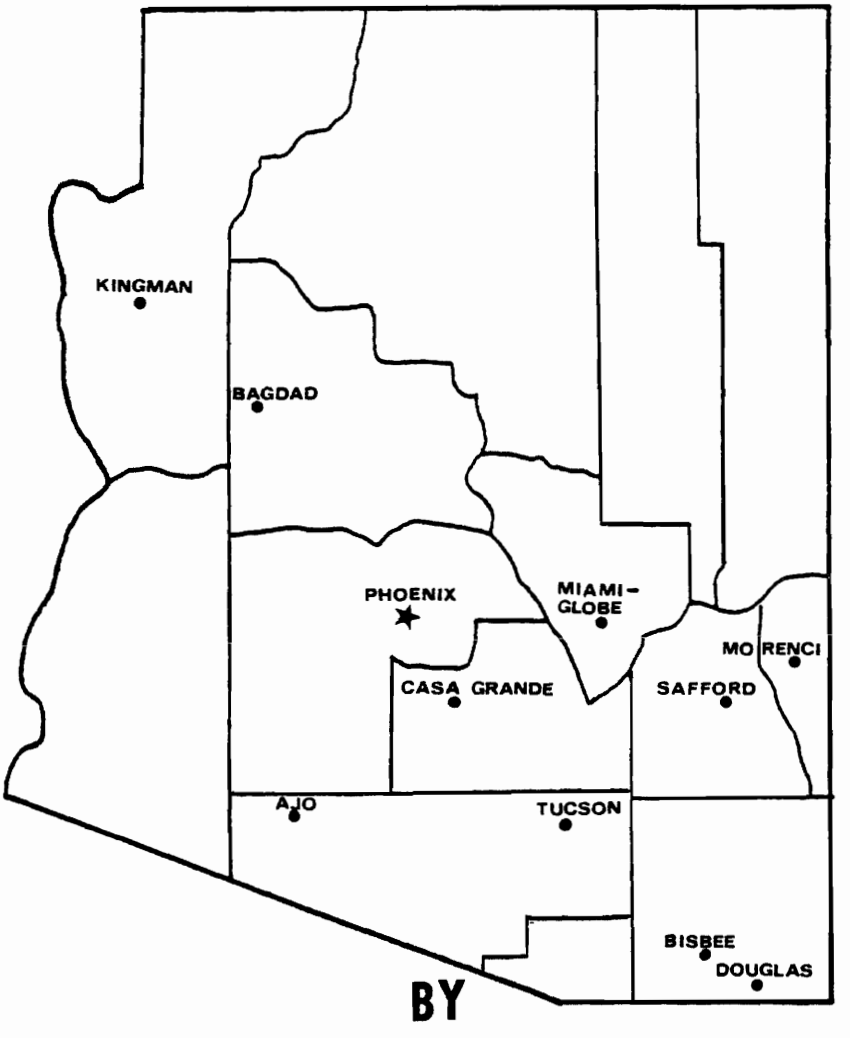
THE PRIMARY COPPER INDUSTRY OF ARIZONA IN 1979–1980

SPECIAL REPORT NO.4



BY

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ARIZONA DEPARTMENT OF MINERAL RESOURCES

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September 1981

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ACKNOWLEDGEMENTS

The author wishes to express appreciation to the copper mining companies for providing production data.

I also wish to thank Michael Greeley for gathering data used in the designed copper capacity and copper reserve tables.

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1/ Throughout this report a "Ton" means a short ton (2000 pounds or .907 metric ton).

INTRODUCTION

The Arizona Department of Mineral Resources presents herein a report on the Arizona Copper Industry. This report profiles Arizona's copper production during 1979 and 1980. A short resume of the operational highlights reported by the major developers and producers in the State is provided. Also included is a very brief review of market and price developments which affected copper production.

The statistical tables in this report include various production and employment figures for 1979 and 1980. Production of recoverable copper is reported for individual mines and by company. Figures showing the importance of copper in the state's mining industry are furnished, as are data on the by-products of copper mining: gold, silver and molybdenum. In addition, historical compilations are included in the tables for leach copper, average grade of ore produced, percent copper recovered, stripping ratios, and employment and earnings. Tables showing designed capacity and copper reserves in Arizona are also provided.

The Department maintains an extensive reference library concerning the copper industry in Arizona. This includes information on individual mines and mining companies, United States Bureau of Mines publications, professional publications, and earlier editions of reports similar to this one.

COPPER PRODUCTION IN ARIZONA

The center of copper production in the United States is Arizona. In 1979 the state produced a record level of 1,042,778 tons of recoverable copper which accounted for 65.5% of the total primary production in the United States. For 1980, the state accounted for 65.2% of the country's newly mined recoverable copper (Table XI).

In 1980 the gross value of mineral production, excluding coal, natural gas and petroleum, in Arizona was $2,414,250,000. Of this total value, copper production contributed approximately 70% (Table VII). Other major contributors to the total value of mineral production in the state included molybdenum, gold and silver. Virtually all the molybdenum and most gold and silver are by-products of the treatment of copper ores (Table VI). As a result, Arizona ranks second in the United States in the production of silver and molybdenum, and fourth in the production of gold.

There were 27 major Arizona copper mines producing in 1980. This total includes the only new mine, the Eisenhower, which began production in January of 1979. Due to improved economic conditions the Bluebird, Christmas, Esperanza and Pima mines resumed mining in 1979. Also in 1979, in-situ leaching was resumed at the Old Reliable mine. Noranda's Lakeshore mine was scheduled to open in 1980 but a shortage of sulfuric acid delayed its achieving production until January of 1981.

Copper produced by leaching methods continued at a relatively high rate in 1979 and 1980. In 1980 copper produced by leaching exceeded 16% of total primary production (Table II). This high percentage was in part due to continued operation of some leach facilities during the strike in 1980.

An interesting development with respect to leach copper is the increasing use of the solvent extraction process. Five solvent extraction plants were in operation prior to 1979. Inspiration and Kennecott added plants in 1979 and 1980 respectively, and Cities Service and Noranda expect to complete construction of solvent extraction plants in 1981. Solvent extraction uses a liquid ion-exchange process to increase the copper concentration of the solution from which the copper is then recovered by electrolytic deposition. The advantages over the cementation process include the end product is high grade copper cathode which can be marketed directly, no air pollution is produced, and there is a net reduction in energy costs.

Table X shows an estimate of the capacity to produce primary copper at each of the state's principal operations. Total estimated design capacity is 1.185 million tons annually. The Arizona mines, their concentrators, and leach plant facilities operated at about 91% of estimated capacity during 1979. Affected by the strike, 1980's production was 73% of capacity.

Employment in the copper industry averaged approximately 22,500 persons in the 1979-1980 period. This is similar to the previous two year period, but down approximately 20% from the record employment of about 28,000 persons in 1974 (Tables XII and XIII). In 1980 the production worker's average hourly production rate was 5.588 tons of ore, a slight improvement over 1978. For the same period the production worker's average hourly earnings rose to $10.10, an increase of $2.23 per hour.

Many factors affect the actual production of copper in Arizona. Most technological factors are so interwoven that to isolate one and describe its impact is extremely difficult and often misleading. An even more difficult task is to properly evaluate the rapidly enlarging domain of socio-political factors that influence the decisions made by the developers of mines and producers of copper. Foremost in any discussion of capacity is the availability of the natural resource, in this case the availability of deposits of copper mineralization of commercial quantity and quality. A chart showing most of Arizona's rich endowment of proven copper reserves is given in Table XV.

It should be emphasized that, although the reserves listed in Table XV total more than 10.5 billion tons of ore (generally as of December 31, 1980), the figures can move upward or downward drastically with changes in technological skill or with changes in United States policy or economy. If, for example, socio-political factors such as capricious rules and regulations imposed by government become too burdensome, many of these deposits may never be developed and many of the existing mines may be closed. Arizona's, and therefore America's, capacity to produce copper would then be seriously harmed.

A BRIEF REVIEW OF THE 1979 AND 1980 COPPER MARKET

Demand for copper was strong in early 1979 when production was at its lowest. Strikes in Canada, severe production and shipping problems in Zambia and Zaire, and bad weather conditions in the U.S. combined to hold output below expected levels. In the U.S., refined consumption for the last three quarters was below that of the corresponding 1978 quarters. During this same period the Canadian strikes were settled, Zaire began to recover from the 1978 invasion, and the U.S. producers increased capacity utilization. For the second half of 1979 freeworld supply and demand appeared to be balanced.

With the firming market trend of late 1978 continuing into 1979, the copper price 1/ at the beginning of the year was $.73/lb. By March the price reached $1.00/lb. It remained near this level thru mid-April when a weakening period set in. Prices were generally in the $.80/lb range until fall, when large amounts of speculative funds, which had been driving up precious metal prices, entered into the copper market. This drove prices up with the producer price hitting $1.15/lb in early October, before a wave of profit taking began. With speculation in copper continuing, the price was $1.05/lb at year's end.

The dominating event of the world copper market in 1980 was the U.S. copper strike which began on July 1 and continued into late November before all the companies had settled. Though costly to the affected U.S. mining companies, it was a blessing to the rest of the world's copper producers. The estimated 300,000 short tons of production lost due to the strike averted a large copper market surplus. Free world consumption in 1980 was down 4.4% as the recession which affected most Western nations limited the demand for copper.

The copper market was bullish in early 1980 as inflation and unsettled world affairs caused continued speculation in copper. The $1.05/lb price at the beginning of the 1980 year rose unsteadily to $1.45/lb in the third week of February. That marked the end of the bull market. Prices fell to $1.00/lb by March 14 and by April 21 dropped to $.90/lb. Through May and June prices moved in the $.88 - .95/lb range. In July with indicators pointing to a long strike, prices pierced $1.00/lb. However, with the weak demand caused by the U.S. recession, that level could not be sustained. As producers began to settle in late summer the price remained in the mid $.90/lb range. With the strike over and the recession continuing to weaken the demand for copper, a low price of $.85/lb was reached on December 11. At the close of the year the price was $.88/lb. For the year, the price averaged $1.014/lb, nearly $.10/lb higher than for 1979.

1/ Prices quoted are Metals Week U.S. Producer Refinery. Quotation is an estimated weighted average based on U.S. mine production and current selling prices of U.S. producers, quoted on a delivered wirebar basis minus $.01/lb shipping cost. Discounts on cathodes are $.00625/lb.

HIGHLIGHTS OF COMPANY OPERATIONS IN ARIZONA

ANAMAX MINING COMPANY

Anamax Mining Company is an equal partnership between Anaconda Company (a wholly owned subsidiary of the Atlantic Richfield Company) and Amax Incorporated.

A 40% increase in copper produced at the Twin Buttes property (including Anamax's share of Eisenhower production) enabled it to regain second place among Arizona's producers in 1979. This was attributed to higher ore production, bringing the operating rate of the sulfide mill up to design capacity (40,000 tons per day) in July, higher mill recovery, and initial delivery of ore from the Eisenhower Mining Company. Due to the higher production, Anamax achieved record levels of by-product molybdenum and silver. This made Twin Buttes the second largest Arizona producer of molybdenum in 1979.

Before the strike began, 1980 concentrate production at Twin Buttes had risen 18% over the comparable 1979 period as a result of improved recovery and plant operation at full capacity. However, during the strike copper cathode production fell as oxide plant operations were cut to about half the normal level. This, combined with the strike's interruption of sulfide operations and a decline of sulfide grade from .94% to .82%, resulted in total production falling about 29% in 1980.

At the end of 1979 Anamax completed construction of a $10 million uranium recovery plant. The plant, designed to recover uranium from copper oxide leach solution, began operation in 1980 with production of 195,000 pounds of uranium oxide in yellow cake. Thus, Anamax becomes the first active copper producer to recover commercial uranium from its copper ores.

The partnership between Amax and Anaconda covers only mining and concentration of the copper sulfide ore. Each company is responsible for smelting, refining and marketing its share of concentrates. Beginning in 1979 most of Amax's share of copper concentrates were sold to Nippon Mining Company, LTD of Japan. Following Anaconda's decision in late 1980 to permanently close the company's smelter at Anaconda, Montana, a contract was negotiated with six Japanese smelters to process or purchase its copper concentrates.

Atlantic Richfield Company has agreed to an October 1979 Federal Trade Commission consent order to divest several copper properties, including Anaconda's interest in Anamax by 1984. Amax would be eligible, under the terms of the order, to acquire this interest and is investigating the possibility of such an acquisition.

ASARCO INCORPORATED

Production at the Mission and San Xavier mines was reduced in 1979 to accomodate milling of ores extracted from the Palo Verde Mine, developed by the Eisenhower Mining Company. The Sacaton and Silver Bell mines operated at normal levels during 1979. The strike, which lasted nearly five months at ASARCO, caused a substantial drop in 1980 production. The non-union Sacaton Mine continued normal operations.

In view of the high molybdenum prices of 1979, ASARCO revised mining plans at the Mission and Silver Bell mines to include the mining of available copper ores with above average molybdenum content. Some areas of low-grade copper mineralization became economical to process because of their relatively high molybdenum content. Total production of molybdenum from these two mines increased nearly 400% over that of 1978.

At the Mission mine, a $22 million equipment program was completed in 1980 which replaced the old truck fleet with larger trucks and replaced existing flotation cells in the mill with large volume cells. The fleet of new 170 ton trucks is expected to reduce fuel consumption by 12.5% per ton of ore hauled. The new flotation cells are expected to reduce power costs by 25% while increasing copper recovery from ore. A reduction of labor and maintenance costs are also expected. An expansion of the by-products plant to increase output of molybdenum by 25% was started in September 1980 and is expected to be completed in 1981.

Development continued at the Sacaton East underground project. Sinking of the 20 foot diameter production shaft advanced to a depth of 1500 feet and a 14 foot diameter ventilation shaft was sunk to a depth of 170 feet by the end of 1980. These shafts are expected to be completed in 1981 allowing underground development work to begin.

Installation of secondary exhaust hoods on the converter furnaces at ASARCO's Hayden smelter was completed in 1980. These secondary hoods capture emissions that evolve during charging and skimming of the converter. The consequent reduction of low-level emissions of sulfur dioxide have resulted in improved air quality control and permitted higher operating rates.

CASA GRANDE COPPER COMPANY

The Casa Grande Copper Company, formed to explore and develop the Casa Grande deposit, is equally owned by the Hanna Mining Company and the Getty Oil Company. Hanna Mining Company is the operating partner.

Delineation drilling of the Casa Grande deposit was completed in 1979. Engineering and metallurgical test work continued into 1980. Progress was made in developing a flowsheet for the recovery of copper. Before determining whether a commercial deposit exists, a mine shaft, bulk sampling program and underground drilling will be required to provide data for further engineering and feasibility studies.

CITIES SERVICE COMPANY

Daily ore production in 1979 at the Pinto Valley mine and mill was increased to 47,500 tons of ore feed per day, 19% over the original design capacity of 40,000 tons per day. Production declined in 1980 to an average slightly above 30,000 tons per day. The decline was mainly due to the 18 week strike by copper workers.

Copper recovery, by dump and in-place leaching, was maintained at the old mining operations of Cities Service and Miami for both years. The solvent extraction-electrowinning plant, which produces copper directly from the Miami leach solutions, operated at its design capacity of one million pounds per month of high quality cathode copper.

Construction of a new solvent extraction-electrowinning plant began in 1979. The plant, designed to recover copper leached from low grade material at the Pinto Valley Mine, is expected to be completed in mid-1981. Development of the Miami East underground mine resumed in September 1979 and should be completed in 1982. When completed, these projects will add 30 million pounds of copper production annually.

CYPRUS MINES CORPORATION

On September 21, 1979, Cyprus Mines Corporation became a wholly owned subsidiary of the Standard Oil Company (of Indiana) at a cost of $117 million cash and 5.1 million shares of Standard stock. In 1980 Cyprus Mines Corporation was made an operating subsidiary of Amoco Mineral Company (100% owned by Standard Oil Company). Both companies moved into new, consolidated headquarters offices in Denver during the year.

Cyprus operations include the Bagdad and Johnson open pit mines, and the Cymet hydrometallurgical demonstration plant near Tucson. In addition, Cyprus is the operator of the Pima mine, of which it owns 50.01%. The non-operating partners, Union Oil Company of California and Utah International, Inc. (wholly owned by the General Electric Company) own 25% and 24.99% respectively.

Operations at the Pima mine, which had been suspended since September 1977, resumed July 6, 1979 at about 33% its former capacity. Ore production continued at 18,500 tons per day until late in 1980 when some of the shut down facilities were rehabilitated. This increased capacity by 75% to 32,500 tons of ore per day. Production was normal at Cyprus Mines in 1980 due to the fact that the strike did not affect their non-union operations. A program to increase capacity at Bagdad began in 1980. Upon completion in 1982, copper production will be approximately 85,000 tons per year.

Since construction of the Cymet Demonstration Plant in November 1978, sulfide concentrates from Bagdad have been processed there to develop baseline data. In 1979 approximately three tons of high quality copper were produced per day utilizing newly developed hydrometallurgical technology. Emphasis has been placed on perfecting a process to economically recover secondary metals, such as gold, molybdenum, and silver. Other objectives of the pilot plant are to optimize the equipment and determine what is needed in a full size plant.

DUVAL CORPORATION

Duval is a wholly owned subsidiary of the Pennzoil Company. Its operations at the Mineral Park and Sierrita mines were generally normal in 1979. Mining and milling operations at the Esperanza mine, suspended since August 8, 1977, were reactivated on April 1, 1979. In 1980 operations at all three mines continued relatively stable. The strike, which disrupted most other companies' operations for months, lasted only five days at Duval and consequently had little effect on production.

Duval's production of copper and molybdenum from the three mines increased in 1979 and again in 1980. For both years, Duval was the leading producer of molybdenum in the state. The Sierrita mine alone contributed 42% of the state's molybdenum production in 1979, while in 1980 it accounted for over 50% and ranked second in the production of copper.

The CLEAR-process hydrometallurgical plant, located near the Sierrita property, treated approximately 25% of Duval's copper concentrate production for both years.

EISENHOWER MINING COMPANY

The Anamax Mining Company and ASARCO Incorporated are equal partners in the Eisenhower Mining Company which was formed to develop the Palo Verde deposit. Mining of the deposit under the joint venture agreement is expected to reduce operating costs greatly for both companies and to lengthen the life of the Mission and San Xavier mines significantly by eliminating some pit slopes and recovering ore that would ordinarily have to be left along property lines.

Production at the mine began in January 1979. ASARCO is the operator of the mine and its share of the ore is processed at the nearby Mission concentrator. Anamax's ore is crushed near the Mission mine and sent on a 6 1/4 mile conveyor to the Twin Buttes mill.

FREEPORT-McMORAN INC.

Freeport Copper Company, a wholly owned subsidiary of Freeport- McMoran Inc., has a 50% interest in a joint venture with ASARCO Inc. for the acquisition, exploration and possible development of copper properties near Casa Grande.

Diamond drilling and land acquisition continued on a limited scale during 1979 and 1980. Further exploration and evaluation will be required before determination can be made of the potential for commercial development.

INSPIRATION CONSOLIDATED COPPER COMPANY

During 1979 Plateau Holdings Inc. essentially completed acquisition of total ownership of Inspiration. Plateau is jointly owned by Hudson Bay Mining and Smelting Co., LTD. of Canada, and by Minerals and Resources Corporation LTD., of Bermuda (Minorco). Hudson Bay and Minorco are affiliated with the Anglo American Corporation of South Africa.

The Inspiration area mines (Joe Bush, Live Oak, Red Hill and Thornton open pits) operated on a seven-day-per-week schedule throughout 1979, except for a planned 20 day shut down for maintenance and repairs in July. The Christmas Mine resumed production at mid-year after having mining operations suspended since July 1, 1977. Although mining at the Ox Hide mine, also suspended July 1, 1977, was not resumed, copper was recovered by way of continued heap leaching operations. Overall production in 1979 was adversely affected by unusual rainfall, low recoveries in the concentrator, operating problems in the acid plant, and smelter curtailments. Mining performance improved in early 1980, due in-part to new equipment. Despite the 115 day strike, production continued from leach operations staffed by salaried personnel. Total production in 1980 was lower due to the strike affected shut down of the smelter and later start up delays.

In October 1979 a new $14 million solvent extraction plant was completed. It is designed to produce 100,000 pounds per day of cathode copper and has eliminated the cement copper operation. In June of 1980 Inspiration's patented ferric cure leach system was put into operation. The system is an innovative means of producing leach solutions quickly and with high recovery rates from ores containing copper oxide minerals and chalcocite. The $16 million ferric cure project, which is integrated with the solvent extraction plant, has resulted in a substantial up-grading of the leach solution.

A $15 million modernization of the concentrator at Inspiration began in the fall. Improvements in copper recovery and reduced energy consumption will result from new flotation equipment and improved metallurgical control.

Further engineering has been done on the Inspiration smelter project which is designed to bring the smelter into full compliance with emission regulations and eliminate operating curtailments. Elements of the project are improvements in crushing, screening, and handling of secondary materials, modernization of process control instrumentation, and modifications to one hoboken converter. A key part of the project lies in the modification of the converters to a design conceived by Inspiration staff. The basic vessel will also be altered and sophisticated gas cleaning and draft control equipment added.

KENNECOTT

Heavy rains at the end of 1978 caused flooding in Kennecott's Ray open pit mine. This adversely affected operations during the beginning of 1979. Production was stopped for three days and was subsequently slowed due to the difficulty of processing wet ore. During the rest of the year operations at the Ray mine and Ray Mines Division's smelter were normal. In 1980 production fell as the strike caused the loss of 71 days of production.

Various steps were taken in 1979 to improve productivity at Ray. These included acquisition of a large 60-R blast-hole drill and two additional 250 ton trucks. A new regrind and filter facility was built to improve concentrate grade. The addition of a $15 million solvent extraction plant was completed in 1980. The solvent extraction plant will produce electrolytic-grade copper ready for direct shipment to fabricators. This will increase overall production by releasing smelter and refining capacity for other materials.

MAGMA COPPER COMPANY

Magma is a wholly owned subsidiary of Newmont Mining Corporation. Production at Magma's two underground mines, Superior and San Manuel, made the company the second largest producer of copper in 1979.

The San Manuel mine is the largest underground metal mining operation in the United States and one of the largest copper producing mines in the state. In 1979 San Manuel operated at near capacity, averaging 61,000 tons of ore per day. Production in 1980 averaged only 65% of 1979 due mainly to the strike and a fire. The fire, which caused no injuries, occurred in a non-working area of the mine and halted production for sixteen days. Development of the deeper Kalamazoo orebody continued with initial production scheduled for 1983. At the Superior mine production was hampered in early 1979 by unusually high ground water flow. To alleviate the problem, additional dewatering equipment was installed in the mine.

Smelting curtailments of about 10% were necessary in 1979 and 1980 for the San Manuel smelter to maintain compliance with air pollution control regulations. In 1979 the $25 million modification of the reverberatory furnaces to burn coal was completed. All of the furnaces can now operate on coal, fuel oil, or natural gas, as availability or prices dictate. Electrostatic precipator capacity was expanded to control particulate emissions from the 300,000 tons of coal per year required to fuel the furnaces.

NORANDA LAKESHORE MINES INC.

Noranda Mines LTD. a Canadian corporation, acquired the Lakeshore mine on April 1, 1979. Noranda Lakeshore mines, a wholly owned subsidiary, is the mine operator.

A limited program of mine and plant rehabilitation was begun, together with a comprehensive study of operational plans. Further defining of the sulphide orebody was done by underground drilling in 1980. Development work proceeded in the oxide orebody. A shortage of sulfuric acid resulting from the strike limited vat leaching and caused stock piling of some development ore. Production of cathode copper commenced in January of 1981. Capital expenditures for the program during 1980 totaled $19 million. Construction of a $7 million solvent extraction plant, which will improve the quality of copper cathode produced, is expected to be completed in July of 1981.

OCCIDENTAL MINERALS CORPORATION

Occidental Minerals ("Oxymin") is a wholly owned subsidiary of the Occidental Petroleum Corporation. In 1979 the company completed the second phase of an in-situ solution mining program of the Van Dyke copper oxide deposit near and within Miami, Arizona. Oxymin reported that tests satisfactorily demonstrated that copper can be recovered in leach solutions amenable to conventional hydrometallurgical treatment.

Through the rest of 1979 and into 1980 Oxymin attempted to obtain the necessary zoning permits for further work on the project. The Miami city council denied the permits saying the leaching solution would contaminate the city's water supply and cause subsidence that would damage structures in town. Oxymin filed suit in Superior Court contending denial of the permits was unconstitutional since it violated the company's right to use its property. The Superior Court agreed with Oxymin, but the city appealed the case to the Court of Appeals in Tucson where it remained without a decision being issued.

On October 8, Oxymin announced it was abandoning its options on the lease of the property, and ending its testing there. In its announcement, Oxymin said that even though tests demonstrated the feasibility of the process in major copper oxide deposits, the decision to terminate the project was made in order to achieve more efficient and timely utilization of Oxymin's capital and personnel resources.

ORACLE RIDGE MINING PARTNERS

Oracle Ridge Mining is a joint venture between Continental Materials Corporation and Union Minere, S.A. of Belgium. The partnership was formed in 1977 to develop the Oracle Ridge deposit and bring it into production.

Development of the property was suspended in January 1979, until an evaluation of several problems could be made. Specific concerns were ground reinforcement and cost, mineral continuity and cost of rock removal. A study of the data indicated that a three-phase project, which will include additional drilling and underground drifting, should be completed before making a decision to resume full-scale development.

The terms of the partnership were changed in 1979 providing Union Minere with management and funding responsibility of the three-phase project. If the project is completed, Union Minere's share of ownership will increase to 55%.

Work on the first phase was started in April of 1980. This phase will more accurately determine the size and grade of the ore reserves. Through the end of the year approximately 6,000 feet of underground drilling and a similar amount of surface drilling and drifting into ore blocks was accomplished. Additional drilling, drifting and geologic evaluations are planned during the balance of phase one, scheduled for completion in mid-1981.

PHELPS DODGE CORPORATION 1979-1980

Phelps Dodge operations continue to lead the state in the production of primary copper. In 1979 the company produced 484,015,905 pounds of recoverable copper, approximately 23% of Arizona's total production. In 1980, due to a 100 day strike and reduced operating rates at Morenci and Metcalf from May till year's end, Phelps Dodge production dropped to 353,071,000 pounds of recoverable copper. This was approximately 20% of Arizona's total production for 1980. For both years the Morenci Mine was the largest single producer in the state.

The production of precipitate copper at Morenci increased by 40% in 1979 compared to 1978. This was the result of the new leaching program on the southwest dumps. Due to higher molybdenum prices, the molybdenum circuit at Morenci was reactivated in 1979. During 1980, replacement of the primary flotation cells at the Morenci concentrator was begun. Initial operation of the new 1,000 cubic feet cells has resulted in a significant increase in copper recovery. At the end of 1980 all ore feed for both the Metcalf and Morenci concentrators were planned to be supplied by the Morenci mine. This should result in lower unit costs due to a lower stripping ratio and slightly higher grade. At the Morenci metallurgical laboratory, work continued on hydrometallurgical processes for recovery of copper from sulfide concentrates as an alternative to smelting.

At New Cornelia, construction of a new molybdenum recovery circuit, which will process 600 tons of copper concentrate per day, was completed and it began operation in November of 1980. In order to extend the life of the New Cornelia mine, the pit limits are being expanded. This will require relocation of the engineering office and locomotive maintenance ship and construction of a new office, changeroom and mine garage. Work on site preparation for these buildings and preproduction stripping has begun.

Development work at the Dos Pobres orebody near Safford continued at a curtailed rate. Capital outlays were $6.1 million in 1979 and $7.7 million in 1980. Development work remains suspended at the Copper Basin deposit near Prescott.

Production rates at Phelps Dodge's Arizona smelters continued at reduced levels due in large part to regulations imposed under state operating permits. The permits require emissions of sulfur dioxide to be curtailed when certain meteorological conditions exist.

In February 1981 Phelps Dodge and the Federal Environmental Protection Agency agreed on a program to bring the Morenci and New Cornelia smelters into compliance with the Clean Air Act by January 1, 1985 for Morenci and December 31, 1985 for New Cornelia. In accordance with this agreement a consent decree was issued by the Federal District Court in Arizona which may result in the expenditure of $150 million at Morenci and $45 million at New Cornelia. At Morenci the program is underway and with it comes the opportunity to eliminate operating curtailments and reduce costs. At New Cornelia no major expenditures are required for two years. During this time an economic evaluation will occur which will decide whether compliance or closure will be its fate.

The Douglas smelter has been granted a variance from sulfur dioxide emission limitation requirements of the Clean Air Act. It also does not comply with particulate emission limitations, but enforcement of the regulations has been stayed administratively. Unless the law or economic conditions change, the costs of compliance with emission regulations will force the Douglas smelter to close by January 1, 1981 at the latest.

RANCHERS EXPLORATION AND DEVELOPMENT COMPANY

Mining of ore at the Blue Bird mine resumed in February 1979, after having been suspended since October 1977. This increased production of cathode copper from the leaching heaps by 180% in 1979. Production continued to increase in 1980 as the mine returned to a normal level of operation.

In-situ leaching of the Old Reliable ore deposit resumed in August of 1979 for the first time since 1975. Operations continued until May 15, 1981 when the mine was permanently closed, making it the first copper deposit whose modern production was entirely by in-place leaching.

TABLE I

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA MINES

Company/Mine	1979 Tons Copper Ore Mined	1979 Pounds Recoverable Copper	1979 Pounds Recoverable Molybdenum	1980 Tons Copper Ore Mined	1980 Pounds Recoverable Copper	1980 Pounds Recoverable Molybdenum
ANAMAX						
Twin Buttes	13,911,000	222,464,000	4,665,000	7,752,000	122,093,000	3,089,000
Cathode Copper		70,343,000			63,719,000	
Eisenhower (ANAMAX Share) 1/				3,930,000	44,751,000	760,000
Total	13,911,000	292,807,000	4,665,000	11,682,000	230,563,000	3,849,000
ASARCO						
Silver Bell	3,720,900	36,663,662	431,222	2,205,400	21,367,848	194,868
Precipitate Cu		6,979,599			4,422,855	
Mission	4,816,900	56,045,541	677,874	1,117,500	14,632,366	70,635
Eisenhower (ASARCO Share)	4,092,500	24,179,992	1,046,416	3,988,000	23,283,514	1,324,470
San Xavier	870,400	11,437,771		502,000	4,292,318	27,607
Sacaton	4,005,637	42,733,829		3,818,700	32,194,410	
Total	17,506,337	178,040,394	2,155,481	11,631,600	100,213,311	1,617,580
CITIES SERVICE MIAMI OPERATIONS						
Miami-Copper Cities Operations						
Precipitate Cu		4,351,000			3,980,000	
Miami						
Cathode Cu		12,636,000			~~11,184~~,000	
Pinto Valley Opns.	17,232,500	141,864,000	715,000	11,064,000	90,056,000	595,000
Total	17,232,500	158,851,000	715,000	11,064,000	105,224,000	595,000

TABLE I CONTINUED

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

Company/Mine	1979 Tons Copper Ore Mined	1979 Pounds Recoverable Copper	1979 Pounds Recoverable Molybdenum	1980 Tons Copper Ore Mined	1980 Pounds Recoverable Copper	1980 Pounds Recoverable Molybdenum
CYPRUS MINES CORPORATION						
Bagdad Mine	14,593,000	116,756,000	3,261,000	15,180,000	115,252,000	2,098,000
Cathode Cu		14,337,000			12,668,000	
Johnson Mine						
Cathode Cu	1,587,600	10,032,003		1,499,600	10,302,407	
Pima Mine	2,571,874	18,028,073	424,225	7,307,944	59,958,780	1,693,989
Total	18,752,474	159,153,076	3,685,225	23,987,544	198,181,187	3,791,989
DUVAL						
Esperanza	5,100,168	25,074,366	2,084,652	6,067,365	35,058,832	2,084,933
Precipitate Cu		6,002,305			9,990,659	
Mineral Park	6,321,605	22,187,904	3,795,450	6,258,100	25,294,199	3,951,197
Precipitate Cu		3,347,638			3,689,876	
Sierrita	34,326,796	202,070,491	16,242,123	35,368,807	206,498,679	17,520,800
Total	45,748,569	258,682,704	22,122,225	47,694,272	280,532,245	23,556,930
INSPIRATION						
Inspiration	6,105,225	64,914,059	207,657	10,127,111 3/	39,515,003	184,774
Precipitate Cu 3/		16,637,767			28,957,744	
Christmas Div.		12,223,735		1,291,958	13,152,050	
Ox Hide Mine		1,178,172			1,015,000	
Total	6,105,225	94,953,733	207,657	11,419,069	82,639,797	184,774
KENNECOTT						
Ray 4/	14,201,623	171,803,260	823,716	11,179,624	138,217,514	694,747
Precipitate Cu		26,502,454			25,874,554	
Total	14,201,623	198,305,714	823,716	11,179,624	164,092,068	694,747

TABLE I CONTINUED

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

Company/Mine	1979 Tons Copper Ore Mined	1979 Pounds Recoverable Copper	1979 Pounds Recoverable Molybdenum	1980 Tons Copper Ore Mined	1980 Pounds Recoverable Copper	1980 Pounds Recoverable Molybdenum
MAGMA						
San Manuel	21,828,705	228,634,356	3,314,209	13,803,276	152,741,000	1,692,700
Repro. Smelter Sla.	220,169	3,467,281				
Superior	973,295	78,052,478		556,846	45,938,000	
Repro. Smelter Sla.	13,973	114,530				
Total	23,036,142	310,268,645	3,314,209	14,360,122	198,679,000	1,692,700
PHELPS DODGE						
Morenci Branch						
Morenci Mine	21,712,798	211,992,000	532,026	17,692,254	184,294,000	283,017
Precipitate Cu		93,983,317			86,840,000	
Metcalf Mine	9,226,043	84,719,353		2,416,752	19,226,000	
New Cornelia Branch	10,188,883	86,005,047		7,042,257	56,659,000	22,190
Copper Queen Branch						
Precipitate Cu		7,316,188			6,052,000	
Total	41,127,724	484,015,905	532,026	27,151,263	353,071,000	305,207
RANCHERS EXPLORATION & DEVELOPMENT CORPORATION						
Bluebird Mine						
Cathode Cu	3,779,043	10,954,614		3,993,213	13,017,064	
Old Reliable						
Precipitate Cu		1,004,550			1,128,449	
Total	3,779,043	11,959,164		3,993,213	14,145,513	
TOTAL LARGE COMPANIES 5/	202,320,637	2,147,037,335	38,220,543	174,162,707	1,727,341,121	36,287,927

TABLE I CONTINUED

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

Source: Production data obtained by request from the copper mining companies.

1/ Eisenhower production included with Twin Buttes in 1979. Eisenhower produced approximately 4.8 million tons of ore and 60,594,000 pounds of copper.

2/ Includes 5,944,207 tons of ferric cure material.

3/ In 1980 becomes copper recovered from ferric cure and dump leaching by solvent extraction.

4/ Includes sulfide material and Sx production from silicate material in 1980.

5/ For a comparison to all copper produced in Arizona with a classification of source material, reported by the U.S. Bureau of Mines, see Tables VIII and IX. Specific comparisons may differ due to time and methods of reporting.

TABLE II

ARIZONA LEACH COPPER PRODUCTION 1/

(Thousand Pounds)

MINE OPERATION	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
ANAMAX MINING COMPANY										
Twin Buttes	--	--	--	--	13,462	57,925	68,772	71,614	70,343	63,719
ASARCO INCORPORATED										
San Xavier 2/	--	--	4,955	11,762	19,384	22,772	12,860	15,183	--	--
Silver Bell	6,297	7,897	8,092	7,860	8,497	8,627	5,012	6,267	6,980	4,423
BIG HOLE MINING COMPANY										
United Verde	165	140	214	44	32	--	--	--	--	--
CITIES SERVICE COMPANY										
Copper Cities	4,376	4,577	4,570	3,295	3,562	3,370	3,346	3,806	4,351	3,984
Miami	12,806	12,170	11,988	11,969	13,076	13,509	11,732	11,703	12,636	11,184
CYPRUS MINES CORPORATION										
Badgad 3/	14,681	13,391	14,267	13,508	14,321	14,606	15,011	14,097	14,337	12,668
Johnson	--	--	--	--	6,143	10,060	10,327	10,205	10,032	10,302
DUVAL CORPORATION										
Esperanza	4,454	2,094	2,268	1,817	3,960	6,412	8,636	7,469	6,002	9,991
Mineral Park	7,315	8,936	6,431	6,801	6,915	6,817	5,260	4,813	3,348	3,690
EL PASO NATURAL GAS										
Emerald Isle	3,822	3,629	2,180	--	--	--	--	--	--	--
INSPIRATION CONSOLIDATED COPPER CO.										
Inspiration	45,588	56,487	50,401	47,765	52,470	45,545	20,883	35,945	16,638	28,958
Ox Hide	7,962	9,673	8,950	9,679	10,107	7,915	4,639	4,147	1,178	1,015
KENNECOTT										
Ray 4/	31,622	31,472	28,369	25,478	24,338	24,374	24,334	25,013	26,502	25,875
McALESTER FUEL COMPANY										
Zonia	4,769	4,778	2,991	2,717	619	--	--	--	--	--

TABLE II CONTINUED

ARIZONA LEACH COPPER PRODUCTION 1/

(Thousand Pounds)

MINE OPERATION	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
NORANDA LAKESHORE										
Lakeshore	--	--	--	--	--	28,407	25,031	--	--	--
PHELPS DODGE CORPORATION										
Copper Queen Branch 5/	8,345	10,000	8,532	6,402	8,377	7,893	8,526	7,932	7,316	6,052
Morenci	14,188	24,493	25,668	22,704	23,778	53,136	41,545	51,362	93,983	86,840
RANCHERS EXPLORATION AND DEVELOPMENT CORPORATION										
Bluebird	12,458	14,680	15,005	15,344	15,122	17,876	17,069	3,926	10,955	13,017
Old Reliable	--	--	5,992	2,175	467	--	--	--	1,005	1,128
PERCENT OF PRIMARY COPPER PRODUCED 6/ 7/	10.9	11.2	10.8	11.0	13.8	16.1	15.3	13.9	13.3	16.4

Source: Arizona Department of Mineral Resources; This Report, Table I.

1/ Copper recovered from precipitate and/or by solvent extraction from material dump, head, vat or insitu leached.

2/ San Xavier discontinued production of siliceous flux and commenced production of copper precipitate as of 5/1/73.

3/ Precipitation replaced by solvent extraction in 1971.

4/ Includes only copper contained in precipitates from dump leaching. Does not include copper production by electrowinning.

5/ Lavender Pit and Copper Queen Mine.

6/ Leach copper compared to total copper produced from all primary sources as reported in "Minerals Yearbook - Area Reports: Domestic," U.S. Bureau of Mines for 1971-1978.

7/ Leach copper compared to total copper produced as reported in Table I for 1979-1980.

TABLE III

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

MINE OPERATION		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
ANAMAX MINING COMPANY 3/												
Twin Buttes	Sulfide	1.24	0.99	0.98	0.82	0.63	0.60	1.12	1.11	1.26	.94	.82
	Oxide	--	--	--	--	--	1.27	1.31	1.30	1.26	1.27	1.26
ASARCO INCOPPORATED												
Mission	Sulfide	.67	.67	.61	.60	.61	.60	.62	.58	.59	.60	.75
Sacaton	Sulfide	--	--	--	--	.63	.74	.71	.70	.67	.68	--
San Xavier	Sulfide	--	--	--	--	--	--	--	--	--	.80	.65
	Oxide 4/	--	--	--	.61	.77	1.05	1.12	--	--	--	--
Silver Bell	Sulfide	.68	.65	.60	.64	.65	.72	.72	.65	.65	--	--
CITIES SERVICE COMPANY												
Pinto Valley	Sulfide	--	--	--	--	--	(.45)	(.45)	.49	.52	.49	.49
CYPRUS MINES CORPORATION												
Bagdad	Sulfide	.75	.81	.70	.70	.74	.70	.60	.59	.52	.50	.50
Bruce	Sulfide	3.33	3.75	3.92	3.68	3.86	3.73	3.54	3.97	closed	--	--
Johnson	Oxide 1/	--	--	--	--	--	.42	.42	.46	.44	.40	.40
Pima	Sulfide	.54	.54	.53	.51	.50	.48	.47	.48	--	.46	.49
DUVAL CORPORATION												
Esperanza	Sulfide	.45	.40	--	.34	.31	--	.29	.29	--	--	.32
Mineral Park	Sulfide	.50	.50	.41	.38	.36	.30	.28	.28	.26	.24	.24
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Sierrita	Sulfide	.28	.27	.29	.28	.29	.33	.35	.34	.33	.34	.34
INSPIRATION CONSOLIDATED COPPER CO.												
Christmas (OP)	Sulfide	.63	.65	.80	.74	.57	.57	.58	.74	--	.74	.73
Inspiration Area	Sulfide	.73	.69	.71	.67	.63	.65	.63	.70	.61	.854	.58
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Ox Hide	Oxide 1/	.37	.36	.30	--	--	.29	.27	.27	--	--	--

TABLE III CONTINUED

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

MINE OPERATION		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
KENNECOTT												
Ray 5/	Sulfide	.97	.90	.89	.91	.83	.90	.86	.921	.856	.876	.916
	Oxide (Silicate)	1.17	1.39	1.25	1.35	1.19	1.231	1.15	--	--	--	--
MAGMA COPPER COMPANY												
San Manuel	Sulfide 2/	--	(.7)	(.7)	--	.70	.64	(.7)	(.7)	.64	.63	.65
Superior	Sulfide	(4.4)	(4.4)	(4.5)	--	--	(4.5)	(4.5)	(4.5)	4.36	4.41	4.32
MCALESTER FUEL COMPANY												
Zonia	Oxide	--	(.53)	(.53)	--	--	(.53)	--	--	--	--	--
NORANDA LAKESHORE												
Lakeshore 6/	Sulfide	--	--	--	--	--	--	.75	.91	--	--	--
	Oxide 1/	--	--	--	--	--	--	1.03	.98	--	--	--
PHELPS DODGE												
Copper Queen	Sulfide	4.36	4.31	4.41	4.06	3.48	5.70	--	--	--	--	--
Lavender	Sulfide	.77	.68	.64	.60	.47	--	--	--	--	--	--
Metcalf	Sulfide	--	--	--	--	--	.84	.86	.70	.79	.78	.69
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Morenci	Sulfide	.85	.85	.83	.82	.82	.79	.80	.81	.80	.72	.82
	Oxide	--	--	--	--	--	--	--	--	--	--	--
New Cornelia	Sulfide	.68	.67	.70	.61	.57	.57	.66	.64	.59	.53	.51
RANCHERS EXPLORATION AND DEVELOPMENT CORPORATION												
Bluebird	Oxide	--	.46	.44	--	--	.48	.58	.79	.70	.40	.40
WEIGHTED AVERAGE SULFIDE GRADE 7/		.73	.64	.64	.60	.57	.56	.61	.57	.61	.64	.58

Source: Company annual Reports, Form 10-K's, and Prospectus; "International Directory of Mining and Mineral Processing Operations", E/MJ; Arizona Department of Mineral Resources.

( ) Percentage in parenthesis is approximate; not used in calculation of weight average.

TABLE III CONTINUED

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

1/ Acid soluble copper.

2/ Sulfide Copper.

3/ Included ANAMAX share of Palo Verde deposit for 1979 and 1980.

4/ Copper bearing silica flux mined 1970-1072.

5/ Grade reported for Kennecott's Ray mine is an average of oxide and sulfide together for 1977 to 1980.

6/ The Lakeshore Mine was owned and operated by the Hecla Mining Company in 1976 and 1977.

7/ Weighted average grade of ore milled; based generally on an assay of total copper.

TABLE IV

PERCENT CONTAINED COPPER RECOVERED AT ARIZONA COPPER MINES 1/

(Percent of Total Copper)

MINE OPERATION		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
ANAMAX MINING COMPANY												
Twin Buttes 6/	Sulfide	80	72	76	72	71	63	68	87	76	85	87
	Oxide	--	--	--	--	--	65	75	76	79	78	76
ASARCO INCORPORATED												
Mission	Sulfide	86	88	89	88	88	88	89	87	87	75	87
Sacaton	Sulfide	--	--	--	--	78	82	82	82	83	78	--
San Xavier	Sulfide	--	--	--	--	--	--	--	--	--	82	66
	Oxide	--	--	--	49	63	67	77	--	--	--	--
Silver Bell	Sulfide	75	78	85	80	78	77	81	78	78	--	--
CITIES SERVICE COMPANY												
Pinto Valley	Sulfide	--	--	--	--	--	--	--	92	89	84	83
CYPRUS MINES CORPORATION												
Bagdad	Sulfide	73	77	88	82	77	81	86	73	83	80	76
Bruce	Sulfide	85	85	90	90	90	93	92	88	closed	--	--
Johnson	Oxide 2/	--	--	--	--	--	43	91	90	96	79	86
Pima	Sulfide	84	86	84	85	85	82	84	79	--	76	84
DUVAL CORPORATION												
Esperanza	Sulfide	83	87	--	87	89	90	91	85	--	--	90
Mineral Park	Sulfide	80	80	77	81	72	81	73	75	76	73	84
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Sierrita	Sulfide	84	91	84	90	89	90	88	88	91	87	86
INSPIRATION CONSOLIDATED COPPER CO.												
Christmas (OP)	Sulfide	75	68	76	66	70	73	77	74	--	--	70
Inspiration Area 3/	Sulfide	39	47	47	45	48	46	45	54	55	53	81
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Ox Hide	Oxide 2/	47	42	67	--	--	76	67	56	--	--	--
KENNECOTT												
Ray	Sulfide	--	--	--	--	--	--	--	--	--	--	--
	Oxide 4/	--	--	--	--	--	--	--	--	--	--	--

TABLE IV CONTINUED

PERCENT CONTAINED COPPER RECOVERED AT ARIZONA COPPER MINES 1/

(Percent of Total Copper)

MINE OPERATION		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
MAGMA COPPER COMPANY												
San Manual	Sulfide 5/	--	--	--	--	90	87	--	--	85	83	95
Superior	Sulfide	--	--	--	--	--	--	--	--	90	91	95
McALESTER FUEL COMPANY												
Zonia	Oxide				In-situ Leach 1973-75							
NORANDA LAKESHORE MINE INC.												
Lakeshore	Sulfide	--	--	--	--	--	--	100	99	--	--	--
	Oxide 2/	--	--	--	--	--	--	98	100	--	--	--
PHELPS DODGE												
Copper Queen	Sulfide	87	88	95	90	90	92	--	--	--	--	--
Lavender	Sulfide	70	64	69	67	52						
Metcalf	Sulfide	--	--	--	--	--	63	54	56	61	59	58
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Morenci	Sulfide	74	76	75	71	74	70	70	72	77	68	64
	Oxide	--	--	--	--	--	--	--	--	--	--	--
New Cornelia	Sulfide	87	86	84	85	85	80	80	82	84	80	79
RANCHERS EXPLORATION AND DEVELOPMENT CORPORATION												
Bluebird	Oxide	--	45	35	--	--	34	36	38	85	36	41

Source: Company Annual Reports and Form 10-K's; E&MJ International Directory; Arizona Department of Mineral Resources.

1/ Recoveries are based on available reported production and average grade of material treated. A number of oxide operations are not listed because of inadequate data.
2/ Percent recovery of acid soluble copper.
3/ Percent recovery in flotation-concentration treatment, after ore has been leached.
4/ Silicate treatment.
5/ Percent recovery of sulfide copper.
6/ Recovery includes ANAMAX's share of Palo Verde 1979 and 1980.

TABLE V

STRIPPING RATIOS AT ARIZONA OPEN-PIT COPPER MINES 1/

(Waste: Ore)

MINE OPERATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
ANAMAX MINING COMPANY											
Twdn Buttes	7.30:1	10.20:1	5.30:1	7.60:1	10.80:1	71.60:1 3/	5.50:1	5.60:1	2.00:1	2.90:1	3.32:1
ASARCO INCORPORATED											
Mission	2.30:1	3.10:1	3.10:1	2.50:1	2.30:1	1.50:1	1.50:1	2.30:1	2.30:1	0.76:1	3.05:1
Sacaton	--	--	--	--	--	6.30:1	5.90:1	4.40:1	2.70:1	3.10:1	2.02:1
San Xavier	--	--	--	--	--	--	5.10:1	5.00:1	1.10:1	1.10:1	6.01:1
Silver Bell	2.70:1	2.60:1	2.50:1	3.50:1	3.40:1	2.00:1	1.60:1	1.80:1	1.40:1	1.50:1	--
CITIES SERVICE COMPANY											
Pinto Valley	--	--	--	--	--	1.80:1	1.70:1	1.70:1	1.60:1	1.80:1	1.07:1
CYPRUS MINES CORPORATION											
Bagdad	4.10:1	4.40:1	5.20:1	5.20:1	4.50:1	1.20:1	9.80:1	7.80:1	1.70:1	1.80:1	1.52:1
Johnson	--	--	--	--	--	0.56:1	1.50:1	1.60:1	2.50:1	1.30:1	2.01:1
Pima	--	--	--	1.60:1	2.80:1	2.00:1	2.00:1	1.60:1	--	5.20:1	6.28:1
DUVAL CORPORATION											
Esperanza	1.50:1	1.40:1	--	1.50:1	1.50:1	0.71:1	1.10:1	1.10:1	--	1.30:1	0.76:1
Mineral Park	1.40:1	1.40:1	0.83:1	0.66:1	0.90:1	0.66:1	2.10:1	1.60:1	1.50:1	1.70:1	1.71:1
Sierrita	3.30:1	1.80:1	1.70:1	1.50:1	1.70:1	1.40:1	1.50:1	1.60:1	1.30:1	1.10:1	1.11:1
INSPIRATION CONSOLIDATED COPPER COMPANY											
Christmas	5.50:1	4.10:1	4.90:1	5.80:1	5.10:1	3.40:1	3.10:1	4.40:1	--	4.40:1	4.40:1
Inspiration Area	1.50:1	1.70:1	1.80:1	1.90:1	2.20:1	3.10:1	1.90:1	2.40:1	2.80:1	3.40:1	2.40:1
Ox Hide	0.21:1	.0026:1	0.43:1	.028:1	0.32:1	0.38:1	0.38:1	0.20:1	--	--	--
KENNECOTT											
Ray	2.10:1	1.70:1	2.70:1	2.60:1	3.00:1	3.50:1	2.60:1	2.50:1	3.10:1	2.70:1	--

TABLE V CONTINUED

STRIPPING RATIOS AT ARIZONA OPEN-PIT COPPER MINES 1/

(Waste: Ore)

MINE OPERATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
PHELPS DODGE CORPORATION											
Lavender	2.70:1	1.50:1	1.20:1	1.10:1	0.83:1	--	--	--	--	--	3.15:1
Metcalf	--	--	--	--	--	2.80:1	1.80:1	1.80:1	1.50:1	2.30:1	1.67:1
Morenci	1.80:1	1.80:1	2.20:1	1.90:1	2.00:1	1.80:1	1.30:1	1.50:1	1.50:1	1.40:1	1.30:1
New Cornelia	1.50:1	2.00:1	1.90:1	1.90:1	1.50:1	1.50:1	1.10:1	1.10:1	1.40:1	1.00:1	2.27:1 2/
RANCHERS EXPLORATION AND DEVELOPMENT CORPORATION											
Bluebird	1.00:1	0.83:1	--	1.00:1	1.30:1	1.30:1	1.80:1	3.30:1	1.50:1	1.50:1	1.50:1
AVERAGE	2.60:1	2.60:1	2.30:1	2.50:1	2.60:1	2.10:1 4/	2.70:1	2.60:1	2.00:1	2.00:1	2.55:1

Source: "Minerals Yearbook - Area Reports: Domestic", U.S. Bureau of Mines; Company Annual Reports; E&MJ International Directory of Mining and Mineral Processing Operations; Arizona Department of Mineral Resources.

1/ Leachable rock included with waste (except at solely leach operations).

2/ Includes preproduction stripping.

3/ Stripping continued as sulfide concentrator was shut down from March 1975 to January 1976.

4/ Excludes ratios at Twin Buttes and Sierrita.

5/ Excludes ratio at Twin Buttes.

TABLE VI

ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD AND SILVER

RECOVERED FROM COPPER ORE

Year	Copper Ore 1/ Tons	Gold 2/ Troy Ounces Value 5/	Silver 2/ Troy Ounces Value 5/ 6/	Molybdenum 3/ 1,000 lbs. Value (in $1,000)	Copper 4/ Pounds Value	Copper 4/ Lbs Cu/ton ore Ave.¢/lb. 7/	Value of Copper Gold, Silver & Molybdenum
1968	101,293,963	89,419 $3,510,600	4,697,394 $10,074,000	12,127 $19,207	1,146,313,600 $ 479,698,900	11.32 41.847	$ 512,498,500
1969	127,848,828	108,718 $4,586,800	5,899,843 $10,564,700	12,699 $20,947	1,477,520,000 $ 702,324,400	11.56 47.534	$ 738,422,900
1970	150,240,842	107,292 $3,904,400	7,130,261 $12,626,700	15,672 $26,700	1,694,294,000 $ 977,608,000	11.28 57.700	$1,020,839,100
1971	149,293,547	93,617 $3,820,510	6,106,204 $9,437,749	22,684 $39,872	1,529,780,500 $ 786,812,004	9.76 51.433	$ 839,942,263
1972	165,914,825	102,526 $5,987,518	6,614,957 $11,143,226	27,216 $46,791	1,695,858,000 $ 858,392,446	10.22 50.617	$ 922,314,190
1973	181,311,945	102,376 $10,013,397	7,164,988 $18,325,173	37,657 $59,372	1,735,012,000 $1,021,314,814	9.57 58.865	$1,109,025,384
1974	178,913,296	90,206 $14,488,424	6,308,721 $29,701,332	28,346 $57,067	1,609,808,000 $1,233,901,735	9.00 76.649	$1,335,158,491
1975	168,750,152	82,759 $13,364,751	6,190,805 $27,354,196	25,030 $61,411	1,502,978,000 $ 954,917,072	8.91 63.535	$1,057,047,019
1976	194,136,559	97,961 $12,276,473	7,308,395 $31,816,805	31,073 $89,148	1,912,430,000 $1,316,210,823	9.85 68.824	$1,449,452,101

TABLE VI CONTINUED

ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD AND SILVER

RECOVERED FROM COPPER ORE

Year	Copper Ore 1/ Tons	Gold 2/ Troy Ounces Value 5/	Silver 2/ Troy Ounces Value 5/	Molybdenum 3/ 1,000 lbs. Value (in $1,000)	Copper 4/ Pounds Value	Copper 4/ lbs Cu/Ton ore Ave.¢/lb. 7/	Value of Copper Gold, Silver & Molybdenum
1977	168,641,401	87,874 $13,032,593	6,696,415 $30,957,660	34,574 $120,497	1,705,240,000 $1,122,184,339	10.11 65.808	$1,166,295,089
1978	178,204,491	92,508 $17,905,108	6,611,781 $35,709,502	33,029 $150,142	1,817,670,000 $1,190,755,617	10.20 65.510	$1,244,520,369
1979	203,977,408	99,549 30,622,766	7,454,306 $82,699,941	35,101 $213,065	1,914,501,095 $1,767,735,441	9.39 92.334	$2,094,081,895
1980 8/	169,650,401	71,533 $43,814,606	5,640,703 $116,376,559	36,299 $324,150	1,521,850,812 $1,543,400,219	8.97 101.416	$2,027,741,384

Source: "Mineral Yearbook - Area Reports: Domestic," U.S. Bureau of Mines.

1/ Includes some copper-zinc, copper-lead, and/or lead-zinc ore in 1972 and thereafter.
2/ Excludes gold and silver recovered from vat or heap leaching of copper ores and from copper tailings, or copper cleanup in 1969 and thereafter.
3/ Molybdenum content of recovered concentrate.
4/ Excludes precipitate copper from dump and in-place leaching.
5/ At average domestic, free market gold price in 1968 and thereafter: year 1968, $39.26 per oz.; 1969, $42.19; 1970, $36.39; 1971, $40.81; 1972, $58.40, 1973, $97.81; 1974, $159.73; 1975, $161.49, 1976, $125.32, 1977, $148.31; 1978, $193.55; 1979, $307.615; 1980, $612.509.
6/ At E/MJ average N.Y. market price for .999 fine silver.
7/ At E/MJ average price, domestic f.o.b. refinery.
8/ Data for 1980 is preliminary.

TABLE VII

MINERAL PRODUCTION IN ARIZONA 1/

Mineral		1979 Quantity	1979 Value (thousand)	1980 p/ Quantity	1980 p/ Value (thousand)
Clay	thousand short tons	138	$ 642	136	$ 730
Copper (recoverable content of ores, etc.)	short tons	1,042,778	1,940,211	878,056	1,695,422
Gem stones		NA	4,000	NA	3,888
Gold (recoverable content of ores, etc.)	troy ounces	101,840	31,316	94,082	57,699
Gypsum	thousand short tons	231	1,245	191	1,153
Lead (recoverable content of ores, etc.)	short tons	390	411	421	362
Lime	thousand short tons	673	27,186	501	23,345
Molybdenum (content of concentrate)	thousand pounds	35,101	213,065	36,299	324,150
Pumice	thousand short tons	940	2,367	1,254	4,006
Sand and gravel	do	30,520 2/	74,716 2/	24,500	65,900
Silver (recoverable content of ores, etc.)	thousand troy ounces	7,479	82,941	6,166	132,572
Stone:					
Crushed	thousand short tons	5,769	21,401	5,450	22,200
Dimension	do	5	110	4	109
Combined value of asbestos, cement (masonry and portland), fluorspar (1979), perlite, pyrite, salt, sand and gravel (industrial), tungsten, and zinc		xx	90,870	xx	82,714
Total		xx	$2,490,481	xx	$2,414,250

Source: "The Mineral Industry of Arizona", U.S. Bureau of Mines, January 1981.

p/ Preliminary.

NA Not available.

XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Does not include production of oil, coal or gas.

2/ Excludes industrial sand; value included in "combined value" figure.

TABLE VIII

ARIZONA MINE PRODUCTION (RECOVERABLE) OF GOLD, SILVER, LEAD AND ZINC IN 1979

BY CLASS OF ORE OR OTHER SOURCE MATERIAL

Source	No. of mines 1/	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Silver	4	87,536	1,801	5,200	2/	2/	
Copper-lead	33	203,977,408	99,549	7,454,306	957,251	351	W
Total 3/	37	204,064,944	101,350	7,459,506	957,251	351	W
Other lode material:							
Gold-silver tailings & copper tailings 4/	3	257,657 5/	490	19,436	1,910	40	
Copper precipitates	11	138,480			83,617		
Total 3/	14	396,137	490	19,436	85,527	40	
Grand Total 3/	42	204,461,081	101,840	7,478,942	1,042,778	390	W

Source: "Minerals Yearbook - Area Reports: Domestic 1978-1979," U.S. Bureau of Mines

1/ Detail will not add to total shown because some mines produce more than one class of material.

2/ Less than 1/2 unit.

3/ Data may not add to total shown because of independent rounding.

4/ Combined to avoid disclosing individual company confidential data.

5/ Excludes newly generated tailings.

W Withheld to avoid disclosing company proprietary data.

TABLE IX

ARIZONA MINE PRODUCTION (RECOVERABLE) OF GOLD, SILVER, COPPER, LEAD AND ZINC IN 1980

BY CLASS OF ORE OR OTHER SOURCE MATERIAL

Source	No. of mines 1/	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold	1	49,999	1,000	500			
Silver	3	3,546	97	20,980			
Total	4	53,545	1,097	21,480			
Copper	27	169,650,401	71,533	5,640,703	760,925	358	W
Lead	3	1,944		1,485		39	
Total 2/	33	169,705,891	72,630	5,663,668	760,925	397	W
Other lode material:							
Gold-silver tailings and copper tailings 3/	2	249,699 4/	143	4,147	1,919	44	
Copper precipitates	8	124,128				71,943	
Total	10	373,826	143	4,147	73,862	44	
Grand Total 2/	33	170,079,717	72,773	5,667,815	834,787	441	W

Source: "Minerals Yearbook - Area Reports; Domestic 1980," U.S. Bureau of Mines. (Preliminary Data)

1/ Detail will not add to total shown because some mines produce more than one class material.

2/ Data may not add to total shown because of independent rounding.

3/ Combined to avoid disclosing individual company confidential data.

4/ Excludes newly generated tailings.

W Withheld to avoid disclosing company proprietary data.

TABLE X

COPPER MINE CAPACITY IN ARIZONA 1/
(Short tons of Recoverable Copper/Year)

OPERATOR	MINE	CAPACITY
Phelps Dodge	Morenci	155,000
Magma	San Manuel	130,000
Anamax	Twin Buttes	126,000 2/
Kennecott	Ray	105,000
Duval	Sierrita	102,000
Cities Service	Pinto Valley	76,500
Cyprus	Bagdad	67,000
Phelps Dodge	Metcalf	65,000
Inspiration	Inspiration Area	45,000
Phelps Dodge	New Cornelia	45,000
Cyprus	Pima	45,000
Magma	Magma (Superior)	40,000
ASARCO 3/	Mission	35,000
ASARCO	Silver Bell	23,000
ASARCO	Sacaton	22,000
Noranda	Lakeshore	21,000
Duval	Esperanza	20,000
Duval	Mineral Park	15,000
ASARCO 3/	Palo Verde	10,000
Ranchers	Bluebird	8,000
Cities Service	Miami	6,000
Inspiration	Christmas	6,000
Cyprus	Johnson	5,000
ASARCO 3/	San Xavier	5,000
Phelps Dodge	Copper Queen/Lavender	3,500
Inspiration	Ox Hide	2,500
Cities Service	Copper Cities	1,500
TOTAL		1,185,000

Source: Arizona Department of Mineral Resources file data; Company Annual Reports and Form 10-K; Professional Publications.

1/ Figures generally represent a current estimate of the productive capacity of primary recoverable copper in concentrates, precipitates, and cathodes. Figures do not represent smelter or refinery capacity. The estimates are based on recent production figures and on capacities of concentrator and leachplant facilities. Other factors affecting actual production include, for example, grade of ore and recovery. Some capacities have been published by the reporting company.

2/ Includes approximately 25,000 tons of copper concentrated annually from ore obtained at the Palo Verde mine.

3/ The Mission mill treats ore from the Mission, San Xavier, and ASARCO's share of Palo Verde mine production.

TABLE XI

MINE PRODUCTION OF RECOVERABLE COPPER IN THE UNITED STATES
(Short Tons)

State	1979	Rank In 1979	1980 3/	Rank In 1980
ARIZONA	1,042,778	1	845,572	1
COLORADO	399	7	457	7
IDAHO	3,988	6	2,996	6
MISSOURI	14,353	5	15,429	5
MONTANA	77,000	4	41,798	4
NEW MEXICO	181,086	3	164,856	3
UTAH	212,834	2	174,819	2
OTHER STATES 1/	58,793		49,584	
TOTAL 2/	1,591,232		1,295,511	

Source: "Minerals Yearbook - Metals, Minerals, 1978-1979," U.S. Bureau of Mines; "Copper In 1980 - Preliminary," U.S. Bureau of Mines.

1/ Includes California, Michigan, Nevada, Oregon, Tennessee, and Washington (1979), and California, Maine, Michigan, Nevada, Oregon, Tennessee, and Washington (1980).

2/ Data may not add to total shown due to independent rounding.

3/ Preliminary.

TABLE XII

"COVERED EMPLOYMENT" AND WAGES IN ARIZONA COPPER MINING AND SMELTING

Year	Average No. Covered Employees 1/	Total Wages	Average Annual Wage	Average Weekly Wage	Tons Copper Ore 2/
1948	11,493	$41,318,524	$3,595	$ 69.13	39,072,204
1949	11,001	40,612,224	3,692	71.00	37,365,611
1950	10,181	41,994,321	4,125	79.33	41,757,273
1951	10,754	47,825,698	4,447	85.52	42,784,388
1952	11,365	54,950,235	4,835	93.14	44,472,522
1953	12,068	62,742,982	5,199	99.98	45,187,838
1954	12,502	65,518,853	5,241	100.79	43,072,894
1955	12,399	71,293,263	5,750	110.58	52,189,728
1956	14,008	83,568,996	5,966	114.73	60,468,580
1957	14,652	85,125,320	5,809	111.71	59,571,834
1958	14,100	74,726,972	5,300	101.93	56,255,809
1959	11,568	72,095,130	6,232	119.85	53,121,545
1960	13,764	90,312,848	6,562	126.19	66,032,439
1961	14,275	97,271,286	6,814	131.04	71,918,991
1962	14,408	101,920,108	7,074	136.04	78,868,147
1963	14,303	104,291,588	7,292	140.23	80,615,132
1964	14,720	113,792,031	7,730	148.65	86,132,039
1965	15,239	122,163,124	8,016	154.16	92,859,535
1966 1/	17,018	137,187,611	8,061	155.02	101,558,298
1967	13,426	108,427,206	8,076	155.31	74,289,203
1968	15,734	136,089,579	8,649	166.33	101,293,963
1969	19,459	173,183,018	8,900	171.15	127,848,828
1970	21,479	201,665,064	9,389	180.56	150,241,000
1971	21,231	211,978,597	9,984	192.00	149,294,000
1972	23,233	254,717,341	10,964	210.85	165,914,825 2/
1973	25,494	291,294,328	11,426	218.89	181,311,945
1974	27,894	340,832,096	12,219	234.98	178,913,296

TABLE XII CONTINUED

"COVERED EMPLOYMENT" AND WAGES IN ARIZONA COPPER MINING AND SMELTING

Year	Average No. Covered Employees 1/	Total Wages	Average Annual Wage	Average Weekly Wage	Tons Copper Ore 2/
1975	25,950	363,349,178	14,002	269.27	168,750,152
1976	25,631	405,289,034	15,812	304.08	194,136,559
1977	23,373	398,539,789	16,835	323.75	168,641,401
1978	21,092	397,790,419	18,860	362.69	178,204,491
1979	23,239	494,963,476	21,299	409.60	203,997,408
1980	21,602	510,168,454	23,617	454.17	169,650,401

Source: This report, Table XIII; "Minerals Yearbook - Area Reports; Domestic", U.S. Bureau of Mines.

1/ "Covered Employment: by law includes all employees of employers of three or more persons. Since the "Average Number of Covered Employees" in this table generally includes practically all workers in copper mining and processing (see Table XIII), the number of employees is greater than that number tabulated under "All Employees" in Table XIV. Prior to 1966 only a portion of the workers in smelting, refining, and rod fabrication were included in this table; the rest of the end-processing workers were separated and classified under "Manufacturing" in Table XIII.

2/ Mine production in short tons of lode ore from "Arizona, Mine Production by Class of Ore", reported by the U.S. Bureau of Mines. In 1972 and thereafter the tonnage may include copper-zinc, copper-lead and lead-zinc ore combined to avoid disclosing individual company confidential data. Data is preliminary for 1980.

TABLE XIII

ARIZONA INDUSTRIES COVERED BY SOCIAL SECURITY

YEAR 1979

Industry	Average Number of Employees 1/	Total Wages	Average Annual Wage	Average Weekly Wage
Copper Mining	19,285	$ 408,778,712	$21,196	$407.63
Copper Smelting, Refining, & Rod Fabrication	3,954	86,184,764	21,797	419.17
TOTAL COPPER MINING & PROCESSING	23,239	$ 494,963,476	$21,299	$409.60
Other Mining, Quarrying & Processing	2,481	54,008,256	21,769	418.63
ALL MINING, QUARRING & PROCESSING	25,720	$ 548,971,732	$21,344	$410.46
Mfg. Except Copper Processing	140,705	2,151,191,912	15,289	294.01
Construction	86,632	1,405,716,295	16,226	312.04
Transp., Utilities, Etc. 2/	45,396	788,328,578	17,366	333.95
Wholesale-Retail Trade	235,951	2,254,717,054	9,556	183.77
Services, Finance and Misc.	243,357	2,621,034,684	10,770	207.12
Agriculture & Related Services	23,775	197,864,896	8,322	160.05
Federal, State & Local Government	190,120	2,428,247,123	12,772	245.62
TOTAL AND AVERAGES	991,656	$12,396,072,274	$12,500	$240.39

TABLE XIII CONTINUED

ARIZONA INDUSTRIES COVERED BY SOCIAL SECURITY

YEAR 1980

Industry	Average Number of Employees 1/	Total Wages	Average Annual Wage	Average Weekly Wage
Copper Mining	18,165	$ 428,656,050	$23,597	$453.81
Copper Smelting, Refining & Rod Fabrication	3,437	81,512,402	23,716	456.08
TOTAL COPPER MINING & PROCESSING	21,602	$ 510,168,454	$23,617	$454.17
Other Mining, Quarrying & Processing	2,932	67,791,964	23,121	444.64
ALL MINING, QUARRYING & PROCESSING	24,534	$ 577,960,418	$23,558	$453.03
Mfg. Except Copper Processing	151,036	2,627,044,335	17,394	334.49
Construction	77,034	1,383,188,669	17,956	345.30
Transp., Utilities, Etc. 2/	48,003	923,297,528	19,234	369.89
Wholesale-Retail Trade	242,971	2,499,786,209	10,288	197.85
Services, Finance and Misc.	257,095	3,086,609,606	12,006	230.88
Agriculture & Related Services	24,197	227,390,723	9,397	180.72
Federal, State & Local Government	210,539	2,725,157,730	12,944	248.92
TOTAL AND AVERAGES	1,035,409	$14,050,435,218	$13,570	$260.96

Source: Research and Statistics Unit, Arizona Department of Economic Security.

1/ Includes all covered employees.

2/ Transportation exclusive of railroads.

TABLE XIV

EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

IN THE UNITED STATES AND ARIZONA 1/

	All Employees		Production Workers											
	Average No. (Thousands)		Average No. (Thousands)		Average Weekly Earnings		Average Weekly Hours		Average Hourly Earnings		Ave. Earnings per Man per Year		Aggregate Man-hours (Thousands)	
Period	2/ Ariz.	3/ U.S.	4/ Ariz.	3/ U.S.	5/ Ariz.	U.S.	Ariz.	U.S.	6/ Ariz.	U.S.	7/ Ariz.	U.S.	8/ Ariz.	U.S.
1968	13.8	28.1	11.1	21.3	$149.21	$161.68	43.0	47.0	$3.47	$ 3.44	$ 7,759	$ 8,407	24,820	52,057
3 mos.	7.5	14.9	4.3	8.3	118.17	129.06	36.7	40.2	3.22	3.21				
9 mos.	15.8	32.5	13.0	25.6	160.11	165.28	45.1	47.8	3.55	3.46				
1969	17.0	33.7	13.9	26.9	166.50	169.00	44.4	46.3	3.75	3.65	8,658	8,788	32,092	64,764
1970	18.8	37.0	14.9	29.5	173.01	175.67	43.8	44.7	3.95	3.93	8,997	9,135	33,936	68,570
1971	18.9	34.7	14.9	26.8	178.50	178.46	42.4	42.9	4.21	4.16	9,282	9,280	32,852	59,785
1972	20.5	38.9	16.1	30.7	194.69	192.19	41.6	41.6	4.68	4.62	10,124	9,994	34,827	66,410
1973	21.5	42.3	17.6	33.7	206.75	206.42	41.6	42.3	4.97	4.88	10,751	10,734	38,072	74,127
1974	24.0	42.8	19.1	33.8	222.16	226.46	39.6	41.1	5.61	5.51	11,552	11,776	39,331	72,237
1975	22.5	37.1	17.9	28.4	247.43	247.14	38.6	39.2	6.41	6.33	12,866	12,903	35,929	57,891
1976	21.7	35.5	17.2	27.0	286.31	280.70	40.1	40.1	7.14	7.00	14,888	14,596	35,865	56,300
1977	19.3	35.1	15.3	26.9	302.99	288.73	39.4	38.6	7.69	7.48	15,755	15,014	31,347	53,994
1978	17.2	35.2	13.7	26.9	344.76	338.40	40.8	40.0	8.45	8.46	17,928	17,597	29,066	55,952
1979	19.3	31.9	15.3	24.6	404.81	405.03	42.3	42.5	9.57	9.53	21,050	21,061	33,654	54,366
1980	17.7	29.4	14.0	22.6	446.19	435.01	41.7	41.0	10.70	10.61	23,202	22,621	30,358	48,183

TABLE XIV CONTINUED

EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

IN THE UNITED STATES AND ARIZONA

	Copper Ore Shipped or Treated (Thousand Short Tons)		Copper in Copper Ore (Recoverable Content) (Thousand Pounds)		Worker Productivity: Copper ore Mined per Man-hour (Tons)		Worker Productivity: Recoverable Copper Mined per Man-hour (Pounds)	
Period	Ariz.	U.S. 9/	Ariz.	U.S. 10/	Ariz.	U.S.	Ariz.	U.S.
1968	101,294	170,054	1,252,919	2,349,046	4.081	3.267	50.480	45.124
1969	127,849	223,752	1,593,544	3,021,590	3.984	3.455	59.656	46.655
1970	150,241	257,729	1,826,734	3,368,957	4.427	3.759	53.829	49.132
1971	149,294	242,656	1,633,568	2,986,599	4.544	4.059	49.725	49.996
1972	165,815	266,831	1,816,618	3,264,113	4.761	4.017	52.161	49.151
1973	173,605	289,998	1,847,635	3,386,357	4.872	3.912	48.530	45.683
1974	178,821	293,443	1,710,744	3,145,148	4.547	4.062	43.496	43.539
1975	168,656	263,003	1,619,535	2,772,111	4.694	4.543	45.076	47.885
1976	194,046	283,736	2,043,168	3,166,889	5.410	5.040	56.968	56.250
1977	168,601	259,974	1,843,949	2,964,539	5.379	4.815	58.824	54.905
1978	178,201	263,973	1,965,072	2,955,210	6.131	4.718	67.607	52.817
1979	186,484	291,878	2,085,556	3,140,110	5.541	5.369	61.971	57.759
1980	169,650	241,090	1,676,111	2,527,920	5.588	5.004	55.212	52.465

Source: Research and Statistics Unit, Arizona Department of Economic Security; "Minerals Yearbook - Metals, Minerals," U.S. Bureau of Mines. "Employment and Earnings", March Issues, U.S. Department of Labor.

TABLE XIV CONTINUED

EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

IN THE UNITED STATES AND ARIZONA 1/

1/ Statistics do not reflect workers in copper smelting, refining and rod fabrication (See Table XIII for comparison).

2/ These figures are estimates made by the Arizona Department of Economic Security, in cooperation with the U.S. Bureau of Labor Statistics, and they include all full and part-time wage and salary workers who were employed in copper mining in any part of the pay periods which included the 12th of each month of the year.

3/ Estimates made by the U.S Bureau of Labor Statistics, in cooperation with the 50 states, and based upon monthly samplings similar to those in 2/ above, adjusted periodically to census benchmarks.

4/ Estimates of production (non-supervisory) workers based upon samplings as in 2/ above. Since 1975, figures have been calculated by the Arizona Department of Mineral Resources dividing the annual number of "All Employees - Arizona" by a factor of 1.26. This factor was derived by comparing the annual number of "All Employees - Arizona" with "Production Workers - Arizona" from 1970 to 1974.

5/ Earnings figures for a particular year is the product of "Average Hourly Earnings" and "Average Weekly Hours" for that year.

6/ Gross payroll aggregates, exclusive of irregular bonuses and other pay not earned in a sample pay period, are divided by gross man-hour aggregates of production and related workers for the period in order to determine average hourly earnings.

7/ "Average Weekly Earnings" times 52 weeks.

8/ Number of production workers times "Average Weekly Hours" times 52 weeks.

9/ Copper ore mined and shipped or treated by concentration, smelting or leaching. Data for 1980 is preliminary.

10/ Recoverable copper from copper ore (see 9/) and from copper precipitates produced from dump and in-place leaching. Prior to 1968 copper from precipitates was not included in this table or similar Department tables. The recoverable copper figure did, however, include an equivalent copper value of byproduct gold and silver; since 1968 no copper equivalents of any metal have been included. Data for 1980 is preliminary.

TABLE XV

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS/SOURCE
ANAMAX MINING CO.	Twin Buttes	Sulfide	305	0.65	Publ. in Amax Inc. 1980 Form 10-K
	" "	Oxide	41	0.96	Publ. in Amax Inc. 1980 Form 10-K
	Helvetia	Sulfide	320	0.64	Publ. 1973; cutoff at 0.3% Cu
	"	Oxide	20	0.55	Publ. 1973; acid soluble Cu; cutoff at 0.3% acid soluble Cu
	Peach Elgin	Mixed	23	0.75	Publ. 1973; cutoff at 0.4% Cu
ASARCO INC.	Mission	Sulfide	94.003	0.76	With .14 Ag oz/ton Publ. In ASARCO 1980 Annual Report
	Poston Butte	Mixed		0.47	32-42 million tons possible Publ. 1972 in EMJ
	Sacaton (OP)	Sulfide	13.503	0.70	Publ. in ASARCO Inc. 1979 form 10-K
	Sacaton East (UG)	Sulfide	14.898	1.25	Publ. in ASARCO Inc. 1979 form 10-K
	San Xavier	Sulfide	165.805	0.52	With .06 oz/t Ag Publ. in 1980 Annual Report
	Silver Bell	Sulfide	19.627	0.67	With .05 oz/t Ag. Publ. in 1980 Annual Report
	" "	Oxide			
AZTEC MINING CORP.	Mame	Oxide	2	1.00	Unpublished est.
BS & K MINING CO.	Atlas	Mixed			

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS/SOURCE
CASA GRANDE COPPER COMPANY	Casa Grande	Mixed	352	1.00	Publ. in Getty Oil Co. 1980 Annual Report
CF&I STEEL CORP.	Dragoon	Oxide			
CITIES SERVICE CO.	Cactus	Oxide			
	Copper Cities	Oxide			
	Miami	Oxide			
	Miami East	Mixed (?)	6.0	3.14	1981 Communication with Company
	Old Dominion	Sulfide			
	Pinto Valley	Sulfide	413.4	0.411	Publ. in 1980 Annual Report included probable Ore
COCHISE DEV. GRP.	Bisbee-North	Mixed (?)	20	0.80	Unpublished est.
COCHISE MINING CORP.	San Juan	Oxide	20	0.50	Unpublished est.
CONTINENTAL OIL CO.	Poston Butte	Mixed	800	0.40	Publ. 1979 from Copper Studies Inc.
CYPRUS MINES CORP.	Bagdad	Sulfide	326	0.49	With 0.03% Mo
	"	Oxide	38	0.33	Acid soluble Cu
	"	Oxide	97	0.19	Stockpile; acid soluble Cu after prior leaching Above as of May 3, 1979 from Cyprus Mines Corp. Prospectus dated 8/15/79
	Bruce	Sulfide	0.1276	3.73	Publ. 1976 in form 10-K with 12.8% Zn
	I-10	Mixed	100	0.52	Unpublished est.; with 0.02% Mo

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS/SOURCE
CYPRUS MINES CORP. (continued)	Johnson	Oxide	6.643	0.50	Acid soluble Cu, Publ. in 1980 EMJ International Directory
	Pima	Sulfide	144.959	0.498	Publ. 1980 EMJ International Directory
DUVAL CORP.	Esperanza	Sulfide	54.959	0.27	With .033% Mo
	Mineral Park	Sulfide	43.832	0.19	With .051% Mo
	Sierrita	Sulfide	398.752	0.30	With .035% Mo Above Publ. in Pennzoil Co. 1980 form 10-K
EISENHOWER MINING CO.	Palo Verde (Anamax)	Sulfide	108.85	0.61	With .11 oz/t Ag
	Palo Verde (ASARCO)	Sulfide	38.15	0.72	With .14 oz/t Ag Above Publ. in 1980 EMJ International Directory
EL PASO CO.	Emerald Isle	Oxide	1.5	0.40	3 million tons at 0.1% Cu USBM RI 8236 Publ. 1977
FREEPORT-MCMORAN INC.	Santa Cruz	Mixed			
INSPIRATION CONS. COPPER CO.	Christmas (OP)	Sulfide	11.613	0.62	Publ. in 1980 Annual Report
	Christmas (OP)	Oxide			
	Christmas (UG)	Sulfide	20.131	1.78	Includes "probable" ore. Publ. in 1980 Annual Report
	Inspiration Area Mines and Ox Hide	Mixed	265.333	0.55	Publ. in 1980 Annual Report Plus recoverable Cu remaining in leach pads.
	Sanchez	Oxide	79.362	0.35	Publ. in 1980 Annual Report

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS/SOURCE
KENNECOTT COPPER CORP.	Chilito	Mixed			
	Lone Star	Mixed	2000	0.41	Reported at Az. Conference AIME Dec. 1977
	Lone Star Ext.	Mixed			
	Ray	Sulfide	606.144	0.70	With .01% Mo, Publ. in "World Mining" May 1981.
	Ray	Silicate	225.760	0.68	Publ. in "World Mining" May 1981
KERR MCGEE CORP.	Red Mountain	Sulfide		0.71	Publ. 1970; 100 Million Tons possible.
KEYSTONE MINERALS INC.	Korn Kob	Oxide	8	0.50	Publ. in "Pay Dirt" July 1973
MAGMA COPPER CO.	Copper Creek	Sulfide			
	Kalamazoo	Sulfide	327.41	0.719	Publ. in Newmont Mining Corp.
	San Manuel	Sulfide	325.943	0.713	1980 Form 10-K
	San Manuel	Mixed	130	0.70	Publ. in "Minerals Yearbook", 1969 Vol. III USBM
	Superior	Sulfide	6.091	5.5	Publ. in Newmont Mining Corp. 1980 Annual Report
	Vekol Hills	Sulfide	105	0.56	Publ. 1978; minable by open pit; with 0.014% Mo; 16 million tons oxide Cu
McALESTER FUEL COMPANY	Zonia	Oxide	20.5	0.53	Publ. in 1980 EMJ International Directory
NAVAJO TRIBE (?)	White Mesa	Oxide	2	0.75	Publ. 1955

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS/SOURCE
NORANDA MINES LTD.	Four Metals	Sulfide	3	0.82	Reported 1965
	Lakeshore	Sulfide (Dissminated)	241	0.70	Published in "Minerals Yearbook" 1969; Vol. III, USBM
	Lakeshore	Sulfide (Tactite)	23.6	1.69	" "
	Lakeshore	Oxide	207	0.71	" "
	Ventura	Sulfide	63	0.26	Reported 1965; with 0.28% MoS_2
ORACLE RIDGE MINING PARTNERS	Oracle Ridge	Mixed(?)	11	2.25	Reported 1977; with 0.64 oz Ag/Ton (Publ. 1979)
S.B. OWENS	Carlota	Oxide	4	0.85	Reported 1979
PHELPS DODGE CORPORATION	Copper Basin	Sulfide	175	0.55	Publ. 1974; minable by open pit with 0.02% Mo
	Copper Queen	Mixed			
	Dos Pobres	Sulfide	400	0.72	Publ. 1977
	Lavender	Sulfide			
	Metcalf	Sulfide	415.970	0.77	Publ. 1975
	Morenci	Sulfide	662.462	0.80	Publ. 1975
	New Cornelia	Sulfide	126.623	0.63	Publ. 1975
	United Verde	Sulfide Oxide			
	W. Copper	Sulfide Oxide	175	0.60	Unpublished est.
RANCHERS EXPLORATION & DEVELOPMENT CO.	Bluebird	Oxide	65	0.50	Publ. in Ranchers 1980 Form 10-K
V.B. SMITH ESTATE	Dynamite	Sulfide			
SQUAW PEAK MINING CO.	Squaw Peak	Sulfide	30	0.35	Unpublished estimate

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS/SOURCE
STANDARD METALS CORPORATION	Antler	Sulfide	5.1	1.95	With 4.13% Zn, 0.94% Pb, & 1.05 oz Ag/ton Publ. in 1978 Annual Report and Form 10-K
STRONG & HARRIS	Strong & Harris	Mixed	60	0.60	Unpublished est.; with 0.70% Zn
SUPERIOR OIL	Pine Flats	Sulfide	12	0.50	Unpublished est.
UNDETERMINED	Mineral Hill	Mixed			
UNION OIL	Turquoise	Oxide	10	0.50	Publ. 1975
UNITED STATES GOVERNMENT	Park Hill	Mixed (?)	30	0.45	Unpublished est.
UNITED STATES GOVERNMENT AND U.S. METALS CORP.	Apex	Mixed (?)			
VAN DYKE COPPER CO. AND SHO-ME COPPER CO.	Van Dyke	Oxide	100	0.50	Publ. 1977

1/ Reserves are given with a grade of average total copper content as of December 31, 1980, unless stated otherwise under "Remarks." As used in this table, reserves generally mean those estimated quantities of ore which, under presently and reasonably foreseen technical and economic conditions may be profitably mined and sold or processed for the extraction of their constituent values.

ARIZONA DEPARTMENT OF MINERAL RESOURCES

The Department was created to aid in the promotion, development and conservation of the mineral resources of the State. Particular emphasis is placed on providing prospectors and small miners with semi-technical assistance and economic information.

The general goal of the Department is developed by working with the following objectives:

- Provide technical assistance to prospectors and operators of small mines.
- Disseminate comprehensive mining and mineral information to the citizens and government officials of Arizona counties.
- Study conditions regarding small mine activity and seek solutions to problems.
- Serve as the State's public bureau of mining and mineral information.
- Maintain and expand the Department's mine file library.
- Provide educational services in the field of mineral resources and mining.
- Analyze proposed Federal and State administrative actions.
- Develop interagency cooperation between the Department and other local State and Federal offices.
- Gather all information available on mineral occurrences, prospects, partially developed properties and known mines in the State in order to promote further exploration.
- Provide publications in the form of mineral reports, annual directories, technical reports, annual mineral industry surveys, information circulars, and media articles.