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THE PRIMARY COPPER INDUSTRY OF ARIZONA IN 1981

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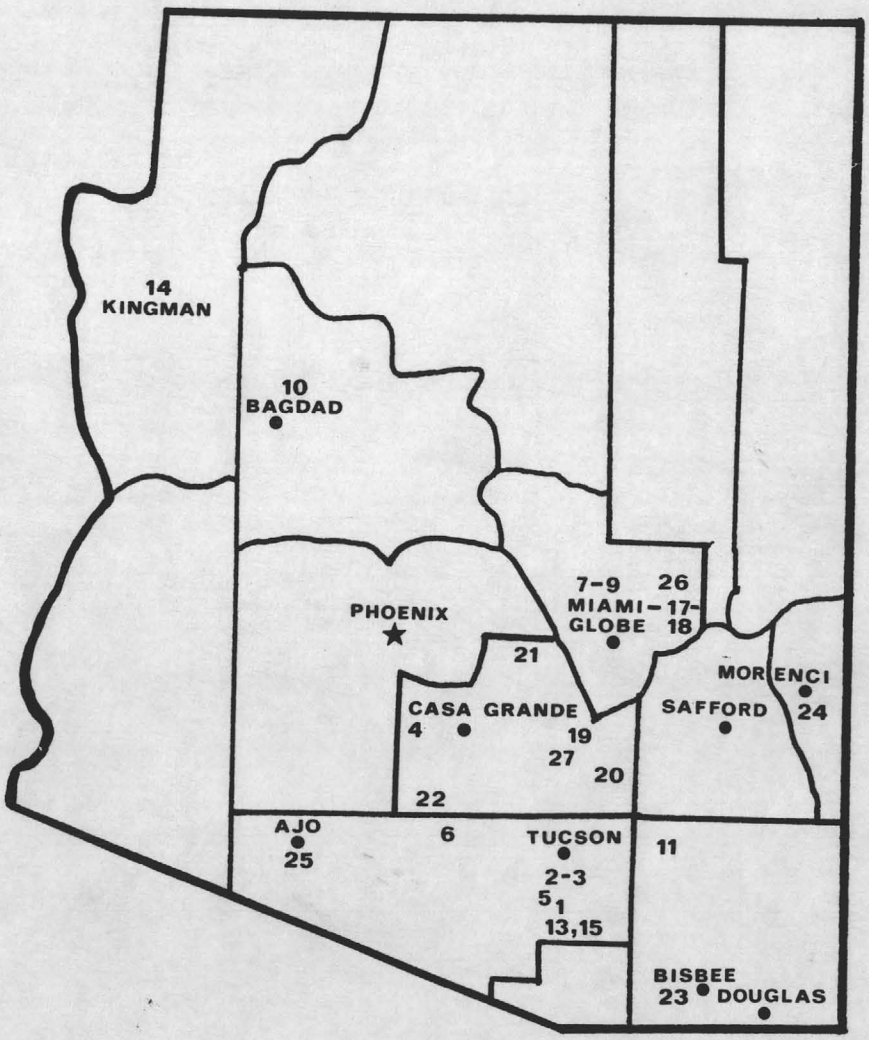

BY

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ARIZONA DEPARTMENT OF MINERAL RESOURCES

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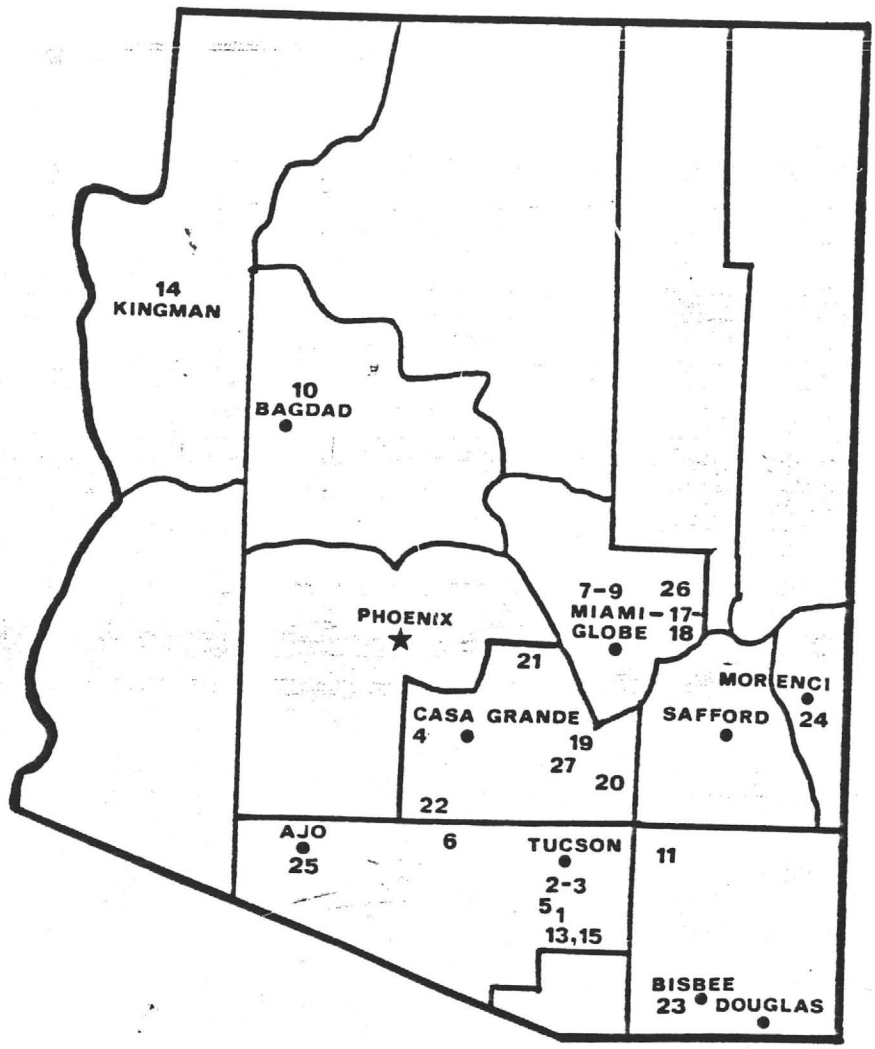

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ABOUT THE COVER

The producing copper mines and operations listed below correspond to the location and numbers on the cover.

#.	COMPANY Mine
ANAMAX MINING COMPANY	
1.	Twin Buttes
2.	Eisenhower
ASARCO INCORPORATED	
2.	Eisenhower
3.	Mission
4.	Sacaton
5.	San Xavier
6.	Silver Bell
CITIES SERVICE COMPANY	
7.	Copper Cities Operations
8.	Miami Mine
9.	Pinto Valley
CYPRUS MINES CORP.	
10.	Bagdad
11.	Johnson
12.	Pima
DUVAL CORP.	
13.	Esperanza
14.	Mineral Park
15.	Sierrita
INSPIRATION CONSOLIDATED COPPER CO.	
16.	Christmas
17.	Inspiration
18.	Oxhide Mine
KENNECOTT CORPORATION	
19.	Ray
MAGMA COPPER CO.	
20.	San Manuel
21.	Superior
NORANDA LAKESHORE MINES, INC.	
22.	Lakeshore
PHELPS DODGE CORP.	
23.	Copper Queen Branch
24.	Morenci Branch Metcalf Mine Morenci Mine
25.	New Cornelia
RANCHERS EXPLORATION & DEVELOPMENT CORP.	
26.	Bluebird
27.	Old Reliable

ACKNOWLEDGEMENT

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

THE PRIMARY COPPER INDUSTRY OF ARIZONA IN 1981

Special Report Number 5

BY

NYAL J. NIEMUTH

November 1982

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1/ Throughout this report a "Ton" means a short ton (2,000 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 1981. 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 1981. Production of recoverable copper is reported for 28 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

Arizona continued to lead the nation in the production of copper. In 1981 the state's mines produced a record 1,143,297 tons of recoverable copper. That amount was 67.8% of the total primary production in the United States (Table XI).

In 1981 the gross value of mineral production excluding coal, natural gas and petroleum in Arizona was $2,537,118,000. Of this total value, copper production contributed over 75% (Table VIII). 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 VII). As a result, Arizona ranks second in the United States in the production of silver and molybdenum, and fourth in the production of gold.

Copper was produced from 27 major Arizona copper mines in 1981. This total includes the Lakeshore mine which reopened in January with a new operator, Noranda Lakeshore Mines, Inc. Molybdenum was recovered as a by-product at 16 of the copper mines during the year (Table I). Seven mines produced 66.76% of Arizona's 1981 copper production. The two largest mines, Morenci and San Manuel, first and second respectively, accounted for more than 25% of the total copper recovered. The Sierrita mine was by far the largest producer by-product molybdenum recovering 42.75% of the state's total (Table VI).

Copper produced by leaching methods during 1981 was a record 352 million pounds and accounted for 15% of total primary production (Table II). Major additions to leach copper production resulted from the reopening of the leach operation at the Lakeshore mine and expanded operation of the Ferric Cure Dump Leach at Inspiration.

The use of solvent extraction electrowinning plants in conjunction with leach operations continued to increase. The construction of new plants was completed during July at the Pinto Valley and Lakeshore mines. This brings the number of solvent extraction electrowinning plants operating in the state to nine. 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. Some of the advantages of the solvent extraction process over the cementation process are: no air pollution is produced, there is a net reduction in energy costs, and the end product is high grade cathode copper which can be marketed directly.

There were 19 open pit copper mines operating in the state this year. The stripping ratio, or the amount of waste removed compared to the amount of ore mined, at these operations is given for the past decade (Table V). The low ratio for 1981 reflects producers efforts to reduce mining costs, by stripping no more waste than necessary to maintain production. In the future, stripping ratios can be expected to increase when the copper market recovers and mining operations become profitable.

Copper sulfide ores were the source of 85% of the copper produced in 1981. The average grade of that sulfide ore has trended slightly downward during

the last decade (Table III). In 1981 a ton of average ore contained 11.6 pounds of copper. That was down less than 10% from 1971 when the average ton of ore contained 12.8 pounds of copper.

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 1.248 million tons annually. The Arizona mines, their concentrators and leach plant facilities, operated at 94% of estimated capacity in attaining the record 1981 production level.

Employment in Arizona's copper industry was 26,031 persons during 1981. That was 20% more than the previous year and the second highest employment level ever recorded (Tables XII and XIII). Worker productivity and earnings figures for the year were also higher. The Arizona production worker's average hourly production of ore was 5.815 tons, .23 tons more than in 1980 (up 4%), while the average hourly production of copper was 61.55 pounds, an increase of 6.5 pounds (up 12%). Earnings of the production worker rose $1.37 to an average hourly rate of $12.07, an increase of 13% (Table XIV).

Affecting production at Arizona's copper mines in 1981 were some events largely beyond the producing companies control. The world wide recession caused demand and prices for copper to fall. Aggravating that situation was foreign government owned CIPEC (Council of Copper Exporting Countries) producers who produced as much copper as they could, without regard for market conditions. United States copper producers (including those in Arizona) were caught in a cost price squeeze due to their higher labor costs, lower ore grades and heavy environmental burdens. Thus, United States Producers were forced to bear a disproportionately large share of the production curtailments.

In Arizona these conditions led to layoffs and reduced work schedules at some mines and additionally resulted in the closure of seven mines. The Metcalf mine of Phelps Dodge was closed all year, though the Metcalf concentrator operated with ore from the Morenci mine. The Old Reliable in-situ leach operation of Ranchers Exploration and Development was permanently closed in May. At Ranchers other operation, the Bluebird mine, mining and heap construction were suspended in July but leaching of existing heaps continued. Closing in mid-December were Duval Corporation's three mines, Esperanza, Mineral Park and Sierrita. At the end of the year operations were shut down at the Christmas mine, owned by Inspiration and all activities except leaching were halted at ASARCO's Silver Bell mine. For more details see the "Highlights of Company Operations" section of this report.

Many factors, some of which have been discussed above, 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 economic and socio-political factors that influence daily the decisions made by the developers 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. 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 10.4 billion tons of ore (generally as of December 31, 1981), the figures can move upward or downward drastically with changes in technological skill or with changes in U.S. 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 will then be seriously harmed.

A BRIEF REVIEW OF THE 1981 COPPER MARKET

The copper industry struggled through a dismal 1981. It was a period of declining prices and weak demand for copper. The lingering recession lowered demand and price to the point that by year end many producers were curtailing production.

Early in the year the demand for copper was spotty, largely due to high interest rates preventing any recovery of the large auto and housing copper markets. The demand for broader based copper products, however, was fairly good and North American producers had little trouble selling their full output. At the beginning of the summer, a copper surplus developed as demand softened further. By September, hope was gone for declining interest rates and an economic recovery in the fall. Consumers reacted by markedly reducing purchases and inventories. Thus, producers were not able to sell their full output. That fact, combined with the poor performance of the by-product metals forced producers to initiate production curtailments.

The declining price trend of late 1980 continued throughout 1981. At the start of the year with the recession already weakening the market, the price 1/ was 88.238¢/lb. The first week of January saw prices at 90.553¢/lb, their high for the year. From that, prices declined to the mid 80¢/lb range until late March when they rose to 87-89¢/lb on the news of strikes outside of the United States. The downward drift resumed in April and persisted until levels of 81-82.5¢/lb were common in late July. Upon expectations of improvements in the economy during autumn, the price rallied to 87¢/lb in mid-August. The rally was short lived and prices slumped in September following the decline in demand. For the rest of the fall, prices hovered near 80¢/lb. The year's low price of 78.413¢/lb occurred many times in late November and December and at the end of the year the price was 78.463¢/lb. The price of copper averaged 83.744¢/lb during 1981, down 17.67¢/lb from 1980.

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 1¢/lb shipping cost. Discounts on cathodes are .625¢/lb.

HIGHLIGHTS OF COMPANY OPERATIONS IN ARIZONA

ANAMAX MINING COMPANY

Anamax Mining Company is an equal partnership between Anaconda Minerals Company, a wholly owned subsidiary of the Atlantic Richfield Company, and AMAX Incorporated. The company operates the Twin Buttes open pit mine, a sulfide concentrator and a solvent extraction-electrowinning plant. Additionally Anamax is an equal partner with ASARCO in the Eisenhower Mining Company. Anamax's share of Eisenhower ore is processed at the Twin Buttes mill.

The concentrator at Twin Buttes processed a record 16 million tons of ore during 1981. Total yield of recoverable copper, including oxide ore and Anamax's share of Eisenhower production, increased 17% over 1980 to 270 million pounds. Production of 206 million pounds of copper from the Twin Buttes mine made it the third largest mine in the state. Output of molybdenum declined 41% to 2.2 million pounds due to lower ore grades. Other by-product production was 1.9 million ounces of silver and 248.3 thousand pounds of uranium oxide in yellow cake.

During the year a 34 cubic yard shovel was put into service at Twin Buttes mine. With more than twice the capacity of other shovels, its use resulted in improved productivity.

By the middle of November, Anamax laid off 50 office workers and 120 hourly employees. The lay offs were part of a production plan originally scheduled for early 1982 and did not affect the production rate at Twin Buttes. Due to the continuing low copper prices, various levels of operations were being examined, but no immediate cuts in production were planned.

ASARCO INCORPORATED

ASARCO owns and operates four open pit mines: Mission, Sacaton, San Xavier, and Silver Bell in Arizona. The Eisenhower open pit mine is operated and partially owned by ASARCO. The company's share of Eisenhower ore is processed with ore from the San Xavier and Mission mines at the Mission concentrator. Other ASARCO operations in the state include a smelter and acid plant at Hayden and development of an underground mine at Sacaton.

ASARCO copper production increased substantially as normal levels of production were resumed after the strike of 1980. At the Mission mill a $6.9 million expansion and modification of the molybdenum by-product plant was underway. Changes in the molybdenum flotation circuit improved efficiency and increased capacity by 25%.

In September development of the Sacaton East underground project was suspended due to high development costs and the weakening copper market.

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The 20 foot diameter production shaft has been sunk to the 1790 level and the 14 foot diameter ventilation shaft has reached a depth of 1070 feet. On the 1790 level, drifts have been advanced a total of 490 feet in three directions.

By December, the reduced demand for copper resulted in an extended holiday period ending January 4, 1982, for the Mission and Sacaton mines. Also affected was the Silver Bell mine which was closed at year's end for an indefinite period. The leaching operations at Silver Bell, which account for about 16% of the mines output, will remain in operation during the mine's shutdown.

At ASARCO's Hayden smelter, preparations began in July for a $132.6 million modernization. The smelter's roaster and reverbatory furnaces will be replaced by a flash smelting furnace which melts concentrates faster and more efficiently in an oxygen enriched atmosphere. The flash furnace will also provide a higher concentration of sulfur dioxide in the gases, thus facilitating recovery of the sulfur dioxide in a new sulfuric acid plant. An oxygen plant will be constructed to provide oxygen to the flash furnace. The modernization will result in an effective 35% increase in capacity by allowing operations to return to the original design capacity of 720,000 tons of concentrate per year. The project is scheduled for completion in 1984 and will settle all major issues between ASARCO and Federal and State environmental authorities relating to air quality control at the Hayden plant.

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.

Operations were suspended in 1981 reflecting the recession and the worsening copper market. When (if) work is resumed, a pilot program will be undertaken to provide data for further engineering and feasibility studies.

CITIES SERVICE COMPANY

The Cities Service Company's Arizona operations are all located in the Globe-Miami area. The company's largest producer is the Pinto Valley open pit mine where copper ore is treated at a sulfide concentrator. Cities Service's other operations include dump leaching at the Copper Cities mine, in-place leaching at the underground Miami mine and the development of the Miami East underground mine.

Production of copper and molybdenum reached record levels at Cities Service mines in 1981. This was due to higher average ore grades and improvements in recovery.

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Cities Service Company Continued

At Pinto Valley, construction of a solvent extraction-electrowinning plant was completed and started operating in July. At full capacity, the solvent extraction plant can process 8.64 million gallons of pregnant leach solution per day. The tankhouse, which houses 44 commercial electrowinning cells, can produce 33,000 pounds of cathode copper per day from the pregnant electrolyte. The plant, Cities Service's second, handles leach solution obtained from dumps of low grade material which, beginning in 1975, have been stockpiled.

Development of the Miami East underground mine continued and is expected to be completed in 1982.

In contrast to many other oil companies who are seeking to diversify into mining, at mid-year Cities Service's management announced that its copper operations were for sale if satisfactory terms could be obtained. Although some inquiries were reported, apparently no deals were pending at year's end.

CYPRUS MINES CORPORATION

Cyprus Mines Corporation is a wholly owned subsidiary of the Standard Oil Company of Indiana. Cyprus' operations include the Bagdad and Johnson open pit operations and the Cymet Hydrometallurgical plant near Tucson.

During 1981 Cyprus Mines Corporation acquired Union Oil's 25% interest in the Pima Mine. Cyprus Mines now owns 75.01% of Pima with Utah International (wholly owned by the General Electric Company) remaining the sole non-operating partner with a 24.99% share.

The expansion program at Bagdad, which began in 1980, continued with mill capacity being increased from 40,000 to 54,000 tons of ore per day. Upon completion of the program, copper production is expected to be 85,000 tons per year.

Operation of the solvent extraction electrowinning plant at the Johnson Mine continued at normal levels. Production of cathode copper totaled 10.7 million pounds.

At Cyprus Pima a mill rehabilitation project to replace 340 old 50 cubic feet flotation cells with 24 new 1,000 cubic feet flotation cells was authorized, but is currently being held in abeyance pending copper price improvement. This proposed rehabilitation would increase capacity at Pima from 32,500 to 46,500 tons of ore per day.

Engineering data from the Cymet Copper Research facility was reviewed following completion of a one year development program. Efforts at Cymet have been directed at perfecting a hydrometallurgical process to economically recover copper and by-product metals, molybdenum, gold and silver from copper concentrates. No decision has been made on a commerical application of the process. With the project complete, the research work force will be cut from 110 to 50 while the lab continues to work on improving the process.

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DUVAL CORPORATION

Duval is a wholly owned subsidiary of the Pennzoil Company. Duval's operation in Arizona consists of the Esperanza and Mineral Park mines, concentrators and precipitation plants, the Sierrita mine and concentrator, the CLEAR hydrometallurgical facility adjacent to Sierrita, and a ferromolybdenum plant at Esperanza.

Output from Duval's three mines made the company the fourth largest producer of copper in 1981. Duval's production of copper and molybdenum was down slightly from 1980, yet the output of molybdenum from Duval's three mines still accounted for nearly 60% of the state's total.

At Sierrita, where by-product molybdenum production accounted for more than 40% of the state's total, equipment was installed in late 1981 to produce a new by-product, rhenium. Recovery will be from gases produced during the roasting of molybdenum. The plant has the capability to produce about 8 pounds of ammonium perrhenate per day.

Development of Duval's portable crushing and conveying system was completed and readied for operation at the Sierrita mine late in 1981. The system, believed to be the first developed for open pit copper mining, can be easily relocated deeper in the pit by a track-type transporter as mining progresses. Crushed ore is then carried out of the mine by a conveyor system rather than trucks, resulting in a reduction of costs.

The CLEAR (Copper Leach Electrolysis and Regeneration) hydrometallurgical plant operated at design capacity and treated 32% of Duval's copper production during the year.

On December 14, Duval became the first major producer to shut down all of its Arizona mines. The action was necessitated by the weakening market for copper and lower prices for its important by-product, molybdenum. Duval continued to operate the CLEAR plant to treat its inventory of copper concentrates following the closure of its mines. The shutdown, originally planned for three months, has since been extended for an indefinite period.

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. The agreement contains provisions governing the amount of ore each partner will receive, the timing of ore delivery, and allocation of costs between the partners.

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Eisenhower Mining Company continued

ASARCO is the mine operator and its share of the ore is processed into concentrates at the Mission mill. Anamax's share of ore is crushed near the mine and sent 6¼ miles on a conveyor to be processed at the Twin Buttes mill.

Ore shipments to the Twin Buttes mill are scheduled to be 5 million tons per operating year for 21 years starting in 1979 and thereafter 2.5 million tons per year for eight years. During 1981, Anamax received 5 million tons of ore from Eisenhower and produced 64 million pounds of copper. Operator ASARCO received nearly 3 million tons of ore from Eisenhower from which it recovered over 25 million pounds of copper.

INSPIRATION CONSOLIDATED COPPER COMPANY

Inspiration Consolidated Copper Company is wholly owned by Plateau Holdings, Inc., a company equally owned by Hudson Bay Mining and Smelting Company and Minerals and Resources Corporation Ltd. (Minorco). Hudson Bay and Minorco are affiliated with the Anglo American Corporation of South Africa.

The company's operations, in the Miami area, include the Inspiration area open pit mines, (Joe Bush, Live Oak, Red Hill and Thornton), a concentrator, a ferric cure leaching solvent extraction electrowinning plant, the Ox Hide mine's precipitation plant, the Inspiration smelter and acid plant. Operations at Christmas include an open pit mine and concentrator.

Copper production at the Inspiration area mines increased substantially over previous years. This was largely the result of improvements in three areas: (1) mine productivity was increased by putting into operation six WABCO haulage trucks of 170 ton capacity. These trucks were used to cope with the demands of waste removal and the expanded dump leaching operation; (2) completion of the $15 million concentrator modernization program resulted in increased throughput and recovery with a resultant lowering of unit operating costs. Major changes at the concentrator included new flotation equipment and controls. Also added was a new filter which has improved performance to the extent that drying of concentrates prior to smelting is not required; (3) expanded operation of the ferric cure dump leach and solvent extraction plant increased cathode copper production by 22 million pounds.

The modernization program on Inspiration's smelter continued in 1981. Changes included the addition of new process control instrumentation for the smelter and acid plant and modification to one of the Hoboken converters. Construction is underway to implement a recovery process for revert material presently in a waste dump. When complete the process will involve crushing the material and then returning it to the converter and the electric furnace at the rate of 80 tons per day.

For the future, Inspiration looks at investing more than $400 million in a continuing modernization and expansion program. The program, already underway and to continue thru the 1980's, includes the $170 million smelter project, $90 million for open pit equipment and the remainder to improve

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milling facilities. Already completed parts of the program include the ferric cure dump leaching system, pre-dryer concentrator at the acid plant, reopening of the Christmas mine and lease and purchase of some open pit mining equipment.

The Christmas mine became another casualty of the poor copper market, closing January 2, 1982 for an indefinite period. The mine, which employed 250, had just reopened in 1979 after being closed for 2 years.

KENNECOTT CORPORATION

On June 4, 1981 the Kennecott Corporation became a wholly owned subsidiary of Standard Oil of Ohio (SOHIO). This followed SOHIO's purchase of the outstanding shares of Kennecott stock for $1.77 billion. SOHIO is 53% owned by a subsidiary of the British Petroleum Company.

SOHIO's longterm plans are to improve Kennecott's competitive position and profitability in copper through cost reduction. This has resulted in a study being undertaken to determine modernization and expansion options for the Ray Mine Division. Kennecott's Ray Division currently operates an open pit mine, a sulfide concentrator, a solvent extraction-electrowinning plant, a dump leaching operation and precipitation plant, and a smelter and an acid plant.

Production of copper at Ray increased to 226 million pounds in 1981. That amount made the Ray mine the third largest producer in Arizona. This was made possible by a full year of operations following the improvements made during strike affected 1980.

MAGMA COPPER COMPANY

Magma is a wholly owned subsidiary of Newmont Mining Corporation. Magma operates two underground mines, San Manuel and Superior, with a concentrator at each. Also located at San Manuel are a smelter and an acid plant.

Three hundred thirty-one million pounds of copper produced from two underground mines made Magma the state's second largest producer in 1981. Seventy-five percent of that total came from the San Manuel mine, the state's second largest while the remainder came from Arizona's deepest mine, Superior.

At the San Manuel mine productivity gains were realized from implementing bottom dump ore cars and from centralized computer assisted monitoring of power, ventilation, compressed air and water flow systems. At the San Manuel concentrator significant energy savings were achieved with the installation of an improved ball mill liner configuration. A new refrigerated air-conditioning system required to maintain good working conditions in the lower mine levels and development headings in Kalamazoo became operational. Development of

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Kalamazoo was halted at year's end reflecting economic conditions. At San Manuel's smelter a new converter aisle scheduling system has provided improved process control and increased efficiency in converter gas collection and acid plant operation. Production cut-backs began at the San Manuel mine and mill with a 10 day maintenance shutdown at year's end. The shutdown reduced December's production of copper by 5 million pounds.

Operations at Superior were generally normal during 1981. Underground drilling encountered promising intersections with two vein structures south of the present workings. Work on those showings continues.

NORANDA LAKESHORE MINES, INC.

The Lakeshore mine, which had been closed since August 1977, reopened in January of 1981. The underground mine is now operated by Noranda Lakeshore Mines, a wholly owned subsidiary of Noranda Mines Ltd. of Canada.

Production of cathode copper from vat leaching of oxide ore began in January. Quality of the cathode copper produced improved in July with start-up of the new $7 million solvent extraction plant. Recovery problems caused by excessive fines in the ore in the vat leaching operation were overcome by mid-year. Severe ground conditions requiring the use of steel supports in virtually every major heading in the mine delayed mine development progress. Consequently, ore draw scheduling difficulties in the underground block cave operation reduced ore production to 82% of that planned for the year. Total output of cathode copper exceeded 26 million pounds.

ORACLE RIDGE MINING PARTNERS

Oracle Ridge is a partnership between Continental Material Corporation and Union Minere, S.A. of Belgium. The partnership was formed to develop the Oracle Ridge deposit located in Pima County and bring it into production. In accordance with an amendment to the partnership agreement, Union Minere's interest was increased to 55% from 45% during 1981.

In 1979 mine development activities were suspended pending completion of a comprehensive 3-phase study of all the geological data, in order to further define the size and scope of the ore reserves. The initial phase was completed in 1979. As a result, phase two involving surface drilling and underground drilling and drifting was begun. This phase continued during 1981 and upon completion, the ore reserves will be recalculated from the data obtained. The third phase will follow. It will be a study to determine the feasibility of bringing the property into production. The feasibility study will also include an estimate of the development and capital costs required.

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PHELPS DODGE CORPORATION

Phelps Dodge has five operating units in Arizona. (1) The Morenci Branch includes the Metcalf and Morenci open pit mines and concentrators, a dump leaching operation and precipitation plant, the Morenci smelter and acid plant. (2) The New Cornelia Branch includes an open pit mine, a concentrator, a smelter and acid plant. (3) The Copper Queen Branch at Bisbee consists of leaching activities at the Lavender Pit, underground mines and dumps, and a precipitation plant. (4) The Douglas Reduction Works operates a smelter with a rated capacity of 700,000 tons per year of input material. (5) The Safford Branch is developing an underground mine ten miles north of Safford.

Phelps Dodge again led the state in the production of copper. In 1981 the company produced 467.7 million pounds of recoverable copper, approximately 20% of Arizona's total production. More than 80% of that production was from the company's and the state's largest mine, Morenci.

Although 1981 mine production increased over strike affected 1980's, it was not up to 1979 levels. This was due to reduced operating rates implemented in response to low copper demand and prices which provided no incentive to maximize production. Specifically, the mining rate at Morenci was reduced 8% in March by adopting a six day work week. Also, the regular summer shutdown and Christmas holiday period were extended. At the start of 1982, production schedules were reduced by 20% thru the use of a four day work week to further curtail output.

At the Morenci mill, two additional banks of 1,000-cubic foot flotation cells were installed as part of the continuing modernization program. Use of the new cells has resulted in improved copper recoveries. The Morenci mine continued to supply both the Morenci and Metcalf concentrators. This supplied a slightly higher grade to the concentrators and for a limited period of time will lower the overall waste to ore ratio. At Metcalf, mill equipment has been installed to permit the grinding circuit to be put under full computer control.

In April a 1,850 acre tract of land adjoining the Metcalf and Morenci mines, known as the Western Copper Property, was purchased from Hanna Mining Company for $10 million. Ownership of this property will permit greater flexibility and efficiency in mining operations at Morenci and Metcalf. Acquisition of the property, which had been under lease, will allow saving in the disposal of waste from the Morenci mine. Estimated reserves for the property are 350 million tons of mixed copper oxides and sulfides with an average grade of 1.0%.

A program to bring the Morenci smelter into compliance with the Clean Air Act by January 1, 1985 began in 1981. The program resulted from a consent decree negotiated with the Environmental Protection Agency. Under the terms of that decree, Phelps Dodge will install facilities at Morenci to produce oxygen, modify two reverberatory furnaces and their associated feeding systems, install new gas collection systems, and upgrade the existing acid plant. Total cost for the project is expected to be $185 million. Full scale testing of a smelting technique using oxygen in the reverberatory furnace confirmed that it can achieve satisfactory smelting rates and produce waste gases sufficiently rich in sulfur dioxide to be treated in the sulfuric acid plant. Construction of a 500 ton per day oxygen plant began in May. Expenditures on the program thru the end of 1981 totaled $17.4 million.

-continued-

At New Cornelia pre-production stripping for pit expansion continued. The locomotive shop and mine engineering building were relocated to accomodate the expansion of the mine. Also completed was the construction of a new mine garage and combination mine office and change room. At the New Cornelia Concentrator, testing of flotation cells larger than those being installed at Morenci indicated that similar improvements in copper recovery may be achieved there.

The consent decree with the Environmental Protection Agency also applies to the smelter at New Cornelia where compliance with the Clean Air Act is required by December 31, 1985. No expenditures are required there until 1985. An evaluation is being made whether closure is economically preferable to spending the approximately $45 million required for the construction modification program.

Development expenditures for the year were $8 million at the Dos Pobres underground project near Safford. Progress was made in driving a drift to connect the number one and number two shafts, which are 10,000 feet apart. Two mine levels were expanded from the number one shaft. A total of $81.8 million has been invested there so far.

Progress was made during 1981 in processing applications to exchange land needed for the Copper Basin Property near Prescott.

Production from leaching at the Copper Queen Branch was 4.6 million pounds. Phelps Dodge's new small mines division produced some gold-silver ore during 1981 from the closed Bisbee underground copper mines.

The Douglas smelter currently operates under a nonferrous smelter order which provides a variance from sulfur dioxide emission limitation requirements of the Clean Air Act. In addition the smelter does not currently comply with particulate emission limitations. However, a new interim limitation has been proposed to apply during the period of the nonferrous smelter order, and which, if adopted, should be achieved by Douglas with presently installed equipment. Unless the law or economic conditions change, the costs of additional facilities needed to comply with emission regulations will force the smelter to close by December 31, 1987 or sooner.

RANCHERS EXPLORATION AND DEVELOPMENT COMPANY

Production continued at normal levels from the Bluebird mine in 1981, with the solvent extraction plant producing over 13 million pounds of cathode copper. However, mining operations were adversely affected by the declining price for copper and the increasing overburden to ore ratio. The stripping of overburden from the deposit ceased early in the year. In July, mining activities were terminated and construction of ore leaching heaps halted. Leaching of existing heaps continued for the rest of the year.

-continued-

Ranchers Exploration
Continued

For the future, Ranchers is considering converting the Bluebird mine to an in-situ leaching operation. The approach under consideration would involve hydraulic fracturing of the deposit, in place leaching with sulfuric acid, collecting the copper bearing liquid in bore holes and pumping it to the present solvent extraction electrowinning plant for cathode production. A pilot operation would be required first and full scale production would probably not occur before 1983 or 1984.

In-situ leaching of the Old Reliable deposit ceased on May 15 and the mine was permanently closed. The mine is believed to be the first in which an entire orebody was fractured with explosives for in-situ leaching. During its 6 years of operation over 10.9 million pounds of copper were recovered. Thus the Old Reliable became the first major copper mine whose modern production came entirely from in-situ leaching.

TABLE I

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

1981

COMPANY/MINE	TONS COPPER ORE MINED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS OF WASTE/OVERBURDEN REMOVED
ANAMAX MINING COMPANY				
Eisenhower (Anamax Share)	5,057,000	64,318,000	555,000	-
Twin Buttes	10,941,000	138,112,000	1,659,000	39,619,000
Cathode Copper	3,684,000	67,922,000	-	-
Total	19,682,000	270,352,000	2,214,000	39,619,000
ASARCO INC.				
Eisenhower (ASARCO Share)	2,994,400	25,554,446	273,685	5,689,600
Mission	4,778,800	67,212,100	537,471	9,603,800
Sacaton	4,103,250	42,030,299	-	5,340,000
San Xavier	1,739,700	17,247,012	32,110	10,746,600
Silver Bell	3,694,300	38,575,788	237,757	5,205,520
Precipitate Cu	-	7,949,601	-	-
Total	17,310,450	198,569,246	1,081,023	36,585,520
CITIES SERVICE COMPANY				
Copper Cities				
Precipitate Cu	-	3,622,000	-	-
Miami				
Cathode Cu	-	10,217,000	-	-
Pinto Valley	19,945,620	165,100,000	1,393,000	33,773,000
Cathode Cu 1/	-	5,519,000	-	-
Total	19,945,620	184,458,000	1,393,000	33,773,000

-continued-

TABLE I
Cont.

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

1981

COMPANY/MINE	TONS COPPER ORE MINED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS OF WASTE/OVERBURDEN REMOVED
CYPRUS MINES CORPORATION				
Bagdad	14,838,000	139,061,000	2,783,000	26,460,000
Cathode Cu	-	13,244,000	-	-
Johnson				
Cathode Cu	1,551,600	10,693,485	-	2,353,000
Pima	11,416,490	85,114,635	1,292,854	34,897,817
Total	27,806,090	248,113,120	4,075,854	63,710,817
DUVAL CORPORATION 2/				
Esperanza	6,268,604	31,492,172	2,504,502	12,234,883
Precipitate Cu	-	11,565,660	-	-
Mineral Park	6,284,936	29,892,180	3,588,199	9,023,584
Precipitate Cu	-	4,193,767	-	-
Sierrita	36,361,191	175,336,469	15,878,805	35,742,438
Total	48,914,731	252,480,248	21,971,506	57,000,905
INSPIRATION CONSOLIDATED COPPER CO.				
Christmas	1,911,383	16,807,786	-	6,194,334
Inspiration	6,714,293	57,807,341	292,442	10,304,722
Cathode Cu	16,562,247	50,532,051	-	-
Ox Hide	-	-	-	-
Precipitate Cu	-	760,910	-	-
Total	25,187,923	125,908,088	292,442	16,499,056

-continued-

TABLE I
(Cont)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

COMPANY/MINE	TONS COPPER ORE MINED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS OF WASTE/OVERBURDEN REMOVED
KENNECOTT CORPORATION				
Ray 3/	14,815,600	200,862,508	787,995	27,882,150
Precipitate Cu	-	25,788,252	-	-
Total	14,815,600	226,650,760	787,995	27,882,150
MAGMA COPPER COMPANY				
San Manuel	22,197,558	246,195,000	4,268,590	NR
Superior	1,021,951	84,923,000	-	NR
Total	23,219,509	331,118,000	4,268,590	NR
NORANDA LAKESHORE MINES INC.				
Lakeshore				
Cathode Cu	1,416,274	26,070,889	NR	NR
Total	1,416,274	26,070,889	NR	NR
PHELPS DODGE CORPORATION				
Copper Queen Branch				
Precipitate Cu	-	4,600,000	-	-
Metcalf	-	-	-	-
Morenci	28,740,707	291,771,000	635,099	46,966,583
Precipitate Cu	-	96,090,000	-	-
New Cornelia	9,709,713	75,254,000	426,067	4,633,700
Total	38,450,420	467,715,000	1,061,166	51,600,283

-continued-

TABLE I
(Cont.)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

COMPANY/MINE	TONS COPPER ORE MINED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS OF WASTE/OVERBURDEN REMOVED
RANCHERS EXPLORATION & DEVELOPMENT CORPORATION				
Bluebird 4/				
Cathode Cu	1,070,839	13,328,498	-	45,547
Old Reliable 5/				
Precipitate Cu	-	149,055	-	-
Total	1,070,839	13,477,553	-	45,547
TOTAL LARGE COMPANIES 6/	236,919,456	2,344,912,904	37,145,576	326,716,278

FOOTNOTES:

NR Not Reported

1/ Cathode copper production commenced at Pinto Valley with the start up of the new solvent extraction electrowinning plant in July, 1981.

2/ Production from Duval's mines stopped on December 14, 1981.

3/ Includes sulfide and silicate ore from the Ray mine and production from both.

4/ Mining and construction of leaching heaps at the Bluebird mine was halted July, 1981.

5/ In-situ leaching of the Old Reliable deposit ceased on May 15, 1981.

6/ For a comparison to ALL copper produced in Arizona with a classification of source materials reported by the U.S. Bureau of Mines see Table IX. Special comparisons may differ due to time and methods of reporting.

TABLE II

ARIZONA LEACH COPPER PRODUCTION 1/

(Thousand Pounds)

MINE OPERATION	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
ANAMAX MINING COMPANY										
Twin Buttes	--	--	--	13,462	57,925	68,772	71,614	70,343	63,719	67,922
ASARCO INCORPORATED										
San Xavier 2/	--	4,955	11,762	19,384	22,772	12,860	15,183	--	--	--
Silver Bell	7,897	8,092	7,860	8,497	8,627	5,012	6,267	6,980	4,423	7,950
BIG HOLE MINING CO.										
United Verde	140	214	44	32	--	--	--	--	--	--
CITIES SERVICE COMPANY										
Copper Cities	4,577	4,570	3,295	3,562	3,370	3,346	3,806	4,351	3,984	3,622
Miami	12,170	11,988	11,969	13,076	13,509	11,732	11,703	12,636	11,184	10,217
Pinto Valley	--	--	--	--	--	--	--	--	--	5,519
CYPRUS MINES CORP.										
Bagdad	13,391	14,267	13,508	14,321	14,606	15,011	14,097	14,337	12,668	13,244
Johnson	--	--	--	6,143	10,060	10,327	10,205	10,032	10,302	10,693
DUVAL CORPORATION										
Esperanza	2,094	2,268	1,817	3,960	6,412	8,636	7,469	6,002	9,991	11,566
Mineral Park	8,936	6,431	6,801	6,915	6,817	5,260	4,813	3,348	3,690	4,194
EL PASO NATURAL GAS										
Emerald Isle	3,629	2,180	--	--	--	--	--	--	--	--
INSPIRATION CONSOLIADTED COPPER COMPANY										
Inspiration	56,487	50,401	47,765	52,470	45,545	20,883	35,945	16,638	28,958	50,532
Ox Hide	9,673	8,950	9,679	10,107	7,915	4,639	4,147	1,178	1,015	761

-continued-

TABLE II Continued
ARIZONA LEACH COPPER PRODUCTION 1/
(Thousand Pounds)

MINE OPERATION	1972	1972	1974	1975	1976	1977	1978	1979	1980	1981
KENNECOTT CORPORATION										
Ray 3/	31,472	28,369	25,478	24,338	24,374	24,334	25,013	26,502	25,875	25,788
MCALESTER FUEL COMPANY										
Zonia	4,778	2,991	2,717	619	--	--	--	--	--	--
NORANDA LAKESHORE MINES INC.										
Lakeshore	--	--	--	--	28,407	25,031	--	--	--	26,071
PHELPS DODGE CORPORATION										
Copper Queen Branch 4/	10,000	8,532	6,402	8,377	7,893	8,526	7,932	7,316	6,052	4,600
Morenci	24,493	25,668	22,704	23,778	53,136	41,545	51,362	93,983	86,840	96,090
RANCHERS EXPLORATION & DEVELOPMENT CORPORATION										
Bluebird	14,680	15,005	15,344	15,122	17,876	17,069	3,926	10,955	13,017	13,328
Old Reliable	--	5,992	2,175	467	--	--	--	1,005	1,128	149
TOTALS	204,417	200,873	189,320	224,630	329,244	282,983	273,482	285,606	282,846	352,246
PERCENT OF PRIMARY COPPER PRODUCED 5/, 6/	11.2	10.8	11.0	13.8	16.1	15.3	13.9	13.3	16.4	15.0

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

1/ Copper recovered from precipitate and/or by solvent extraction from material dump, heap, vat or in-situ leached.

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

3/ Includes only copper contained in precipitates from dump leaching. Does not include copper production by electro-winning.

4/ Lavender Pit and Copper Queen Mine.

5/ 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 1972-1978.

6/ Leach copper compared to total copper produced as reported in Table I for 1979-1981.

TABLE III

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

MINE OPERATION		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
ANANAX MINING COMPANY 3/												
Twin Buttes	Sulfide	0.99	0.98	0.82	0.63	0.60	1.12	1.11	1.26	.94	.82	.74
	Oxide	--	--	--	--	1.27	1.31	1.30	1.26	1.27	1.26	1.20
ASARCO INCORPORATED												
Mission	Sulfide	.67	.61	.60	.61	.60	.62	.58	.59	.60	.75	.75
Sacaton	Sulfide	--	--	--	.63	.74	.71	.70	.67	.68	--	--
San Xavier	Sulfide	--	--	--	--	--	--	--	--	.80	.65	.65
	Oxide 4/	--	--	.61	.77	1.05	1.12	--	--	--	--	--
Silver Bell	Sulfide	.65	.60	.64	.65	.72	.72	.65	.65	--	--	--
CITIES SERVICE COMPANY												
Pinto Valley	Sulfide	--	--	--	--	(.45)	(.45)	.49	.52	.49	.49	.46
CYPRUS MINES CORPORATION												
Bagdad	Sulfide	.81	.70	.70	.74	.70	.60	.59	.52	.50	.50	.50
Bruce	Sulfide	3.75	3.92	3.68	3.86	3.73	3.54	3.97	closed	--	--	--
Johnson	Oxide 1/	--	--	--	--	.42	.42	.46	.44	.40	.40	.40
Pima	Sulfide	.54	.53	.51	.50	.48	.47	.48	--	.46	.49	.49
DUVAL CORPORATION												
Esperanza	Sulfide	.40	--	.34	.31	--	.29	.29	--	--	.32	.29
Mineral Park	Sulfide	.50	.41	.38	.36	.30	.28	.28	.26	.24	.24	.32
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Sierrita	Sulfide	.27	.29	.28	.29	.33	.35	.34	.33	.34	.34	.30
INSPIRATION CONSOLIDATED COPPER CO.												
Christmas (OP)	Sulfide	.65	.80	. 74	.57	.57	.58	.74	--	.74	.73	.62
Inspiration Area	Sulfide	.69	.71	.67	.63	.65	.63	.70	.61	.854	.58	.58
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Ox Hide	Oxide 1/	.36	.30	--	--	.29	.27	.27	--	--	--	--

-continued-

TABLE III Continued

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

MINE OPERATION		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
KENNECOTT CORPORATION												
Ray 5/	Sulfide	.90	.89	.91	.83	.90	.86	.921	.856	.876	.916	.969
	Oxide (Silicate)	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	.635
Superior	Sulfide	(4.4)	(4.5)	--	--	(4.5)	(4.5)	(4.5)	4.36	4.41	4.32	4.48
MCALESTER FUEL COMPANY												
Zonia	Oxide	(.53)	(.53)	--	--	(.53)	--	--	--	--	--	--
NORANDA LAKESHORE MINES INC.												
Lakeshore 6/	Sulfide	--	--	--	--	--	.75	.91	--	--	--	--
	Oxide 1/	--	--	--	--	--	1.03	.98	--	--	--	1.00
PHELPS DODGE CORPORATION												
Copper Queen	Sulfide	4.31	4.41	4.06	3.48	5.70	--	--	--	--	--	--
Lavender	Sulfide	.68	.64	.60	.47	--	--	--	--	--	--	--
Metcalf	Sulfide	--	--	--	--	.84	.86	.70	.79	.78	.69	--
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Morenci	Sulfide	.85	.83	.82	.82	.79	.80	.81	.80	.72	.82	.74
	Oxide	--	--	--	--	--	--	--	--	--	--	--
New Cornelia	Sulfide	.67	.70	.61	.57	.57	.66	.64	.59	.53	.51	.50
RANCHERS EXPLORATION & DEVELOPMENT CORPORATION												
Bluebird	Oxide	.46	.44	--	--	.48	.58	.79	.70	.40	.40	.40
WEIGHTED AVERAGE SULFIDE GRADE 7/		.64	.64	.60	.57	.56	.61	.57	.61	.64	.58	.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.

1/ Acid soluble copper.

-continued-

TABLE III Continued

2/ Sulfide copper.

3/ Included ANAMAX share of Palo Verde deposit for 1979-1981.

4/ Copper bearing silica flux mined 1971-1972.

5/ Grade reported for Kennecott's Ray mine is an average of oxide and sulfide together for 1977 to 1981.

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		1971	1972	1972	1974	1975	1976	1977	1978	1979	1980	1981
ANAMAX MINING COMPANY												
Twin Buttes 5/	Sulfide	72	76	72	71	63	68	87	76	85	87	85
	Oxide	--	--	--	--	65	75	76	79	78	76	77
ASARCO INCORPORATED												
Mission	Sulfide	88	89	88	88	88	89	87	87	75	87	94
Sacaton	Sulfide	--	--	--	78	82	82	82	83	78	--	--
San Xavier	Sulfide	--	--	--	--	--	--	--	--	82	66	76
	Oxide	--	--	49	63	67	77	--	--	--	--	--
Silver Bell	Sulfide	78	85	80	78	77	81	78	78	--	--	--
CITIES SERVICE COMPANY												
Pinto Valley	Sulfide	--	--	--	--	--	--	92	89	84	83	94
CYPRUS MINES CORPORATION												
Bagdad	Sulfide	77	88	82	77	81	86	73	83	80	76	94
Bruce	Sulfide	85	90	90	90	93	92	88	closed	--	--	--
Johnson	Oxide 2/	--	--	--	--	43	91	90	96	79	86	86
Pima	Sulfide	86	84	85	85	82	84	79	--	76	84	76
DUVAL CORPORATION												
Esperanza	Sulfide	87	--	87	89	90	91	85	--	--	90	87
Mineral Park	Sulfide	80	77	81	72	81	73	75	76	73	84	75
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Sierrita	Sulfide	91	84	90	89	90	88	88	91	87	86	80
INSPIRATION CONSOLIDATED COPPER CO.												
Christmas (OP)	Sulfide	68	76	66	70	73	77	74	--	--	70	71
Inspiration Area 3/	Sulfide	47	47	45	48	46	45	54	55	53	81	74
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Ox Hide	Oxide 2/	42	67	--	--	76	67	56	--	--	--	--

-continued-

TABLE IV Continued

PERCENT CONTAINED COPPER RECOVERED AT ARIZONA COPPER MINES
(Percent of Total Copper)

MINE OPERATION		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
KENNECOTT CORPORATION												
Ray	Sulfide	--	--	--	--	--	--	--	--	--	--	70
MAGMA COPPER COMPANY												
San Manuel	Sulfide 4/	--	--	--	90	87	--	--	85	83	95	87
Superior	Sulfide	--	--	--	--	--	--	--	90	91	95	93
MCALESTER FUEL COMPANY												
Zonia	Oxide	In-situ Leach 1973-75										
NORANDA LAKESHORE MINES INC.												
Lakeshore	Sulfide	--	--	--	--	--	100	99	--	--	--	--
	Oxide 2/	--	--	--	--	--	98	100	--	--	--	92
PHELPS DODGE CORP.												
Copper Queen	Sulfide	88	95	90	90	92	--	--	--	--	--	--
Lavender	Sulfide	64	69	67	52	--	--	--	--	--	--	--
Metcalf	Sulfide	--	--	--	--	63	54	56	61	59	58	--
	Oxide	--	--	--	--	--	--	--	--	--	--	--
Morenci	Sulfide	76	75	71	74	70	70	72	77	68	64	69
	Oxide	--	--	--	--	--	--	--	--	--	--	--
New Cornelia	Sulfide	86	84	85	85	80	80	82	84	80	79	78
RANCHERS EXPLORATION & DEVELOPMENT CORPORATION												
Bluebird	Oxide	45	35	--	--	34	36	38	85	36	41	156 6/

Source: Company Annual Reports and Form 10-K's; E & MJ International Directory; Arizona Dept. 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 for 1971-1979.

4/ Percent recovery of sulfide copper.

5/ Recovery includes ANAMAX's share of Palo Verde 1979-1981.

6/ Recovery by leaching heaps continued after mining was terminated in July.

TABLE V

STRIPPING RATIOS AT ARIZONA OPEN PIT COPPER MINES 1/

(Waste:Ore)

MINE OPERATION	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
ANAMAX MINING COMPANY											
Twin Buttes	10.20:1	5.30:1	7.60:1	10.80:1	71.60:1 5/	5.50:1	5.60:1	2.00:1	2.90:1	3.32:1	3.62:1
ASARCO INCORPORATED											
Eisenhower 5/	--	--	--	--	--	--	--	--	--	--	.71:1
Mission	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	2.01:1
Sacaton	--	--	--	--	6.30:1	5.90:1	4.40:1	2.70:1	3.10:1	2.02:1	1.30:1
San Xavier	--	--	--	--	--	5.10:1	5.00:1	1.10:1	1.10:1	6.01:1	6.18:1
Silver Bell	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	--	1.41:1
CITIES SERVICE COMPANY											
Pinto Valley	--	--	--	--	1.80:1	1.70:1	1.70:1	1.60:1	1.80:1	1.07:1	1.77:1
CYPRUS MINES CORPORATION											
Bagdad	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	1.78:1
Johnson	--	--	--	--	0.56:1	1.50:1	1.60:1	2.50:1	1.30:1	2.01:1	1.52:1
Pima	--	--	1.60:1	2.80:1	2.00:1	2.00:1	1.60:1	--	5.20:1	6.28:1	3.06:1
DUVAL CORPORATION											
Esperanza	1.40:1	--	1.50:1	1.50:1	0.71:1	1.10:1	1.10:1	--	1.30:1	0.76:1	1.95:1
Mineral Park	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	1.44:1
Sierrita	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	.98:1
INSPIRATION CONSOLIDATED COPPER COMPANY											
Christmas	4.10:1	4.90:1	5.80:1	5.10:1	3.40:1	3.10:1	4.40:1	--	--	4.40:1	3.24:1
Inspiration Area	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	1.53:1
Ox Hide	.0026:1	0.43:1	.028:1	0.32:1	0.38:1	0.38:1	0.20:1	--	--	--	--
KENNECOTT CORPORATION											
Ray	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	3.15:1	1.88:1

-continued-

TABLE V Continued

STRIPPING RATIOS AT ARIZONA OPEN PIT COPPER MINES [1]
(Waste:Ore)

MINE OPERATION	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
PHELPS DODGE CORPORATION											
Lavender	1.50:1	1.20:1	1.10:1	0.83:1	--	--	--	--	--	--	--
Metcalf	--	--	--	--	2.80:1	1.80:1	1.80:1	1.50:1	2.30:1	1.62:1	--
Morenci	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 [2]	1.63:1 [2]
New Cornelia	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]	.48:1 [2]
RANCHERS EXPLORATION & DEVELOPMENT CORPORATION											
Bluebird	0.83:1 [7]	--	1.00:1 [7]	1.30:1	1.30:1	1.80:1	3.30:1	1.50:1	1.50:1	1.50:1	.003:1 [6]
WEIGHTED AVERAGE *	3.03:1	2.36:1	2.51:1	2.70:1	3.03:1 [4]	1.79:1	2.21:1	1.75:1	1.75:1	1.90:1	1.57:1

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; Company submitted data for 1981.

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/ Without Twin Buttes the ratio would be 1.89:1.
5/ Mining is done by ASARCO, includes ANAMAX's share of ore.
6/ Stripping of overburden ceased in January but mining continued until July.
7/ Not used in calculation of weighted average.

* NOTE: These are now weighted averages so use caution in making comparisons to the averages presented in previous editions of this report.

TABLE VI

RANK OF ARIZONA'S COPPER MINES
BY PRODUCTION OF COPPER AND MOLYBDENUM

	COPPER 1/		MOLYBDENUM	
RANK	Mine/Company Copper Produced, lb.	% of Ariz. Production	Mine/Company Moly. Produced, lb.	% of Ariz. Production
1	Morenci Mine/Phelps Dodge 387,861,000	16.54%	Sierrita/Duval 15,878,805	42.75%
2	San Manuel Mine/Magma 246,195,000	10.50%	San Manuel/Magma 4,268,590	11.49%
3	Ray/Kennecott 226,650,760	9.67%	Mineral Park/Duval 3,588,199	9.66%
4	Twin Buttes/Anamax 206,034,000	8.79%	Bagdad/Cyprus 2,783,000	7.49%
5	Sierrita/Duval 175,336,469	7.48%	Esperanza/Duval 2,504,502	6.74%
6	Pinto Valley/Cities Service 170,619,000	7.28%	Twin Buttes/Anamax 1,659,000	4.47%
7	Bagdad/Cyprus 152,305,000	6.48%	Pinto Valley/Cities Service 1,393,000	3.75%
TOTAL	1,565,001,229	66.74%	32,075,096	86.35%

Source: Arizona Department of Mineral Resources; This Report, Table I.
1/ Precipitate and/or cathode copper included in production total where applicable.

TABLE VII

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
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
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

-continued-

TABLE VII 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
1980	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
1981 8/	216,787,430	95,496 $43,891,299	7,565,368 $ 79,575,340	35,600 $273,052	2,143,898,000 $1,795,385,941	9.89 83.744	$2,191,904,580

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 annual domestic, free market gold price in 1970 and thereafter: 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; 1981, $459.614.

6/ At E&MJ average annual N.Y. market price for .999 fine silver.

7/ At E&MJ average annual price, domestic FOB refinery.

8/ Data for 1981 is preliminary.

TABLE VIII

MINERAL PRODUCTION IN ARIZONA 1/

MINERAL	1980 Quantity	1980 Value (thousand)	1981 p/ Quantity	1981 p/ Value (thousand)
Clays---------- thousand short tons --	151	1,151	133	984
Copper (recoverable content of ores, etc.)short tons-	848,541	1,738,169	1,127,653	1,915,000
Gem stones ----------	NA	3,100	NA	3,150
Gold (recoverable content of ores, etc.) troy ounces-	79,691	48,816	101,900	47,500
Gypsum---------- thousand short tons --	209	2,017	203	2,037
Lead (recoverable content of ores, etc.) short tons -	442	375	992	800
Lime ---------- thousand short tons --	514	23,904	558	26,988
Molybdenum (content of concentrate)thousand pounds --	36,299	324,150	35,600	273,052
Pumice ---------- thousand short tons --	990	3,228	1,078	3,298
Sand and gravel ----------do----------	24,399	73,773	22,600	68,600
Silver (recoverable content of ores, etc.) thousand troy ounces--	6,285	129,724	8,095	89,050
Stone:				
Crushed ----------thousand short tons --	5,224	21,565	5,235	24,881
Dimension ----------do----------	W	45	W	48
Combined value of asbestos, cement (masonry & portland), perlite, pyrites, salt, tungsten, vanadium (1981), zinc, and values indicated by symbol W.	XX	83,032	XX	81,730
Total	XX	$2,453,049	XX	$2,537,118

Source: "The Mineral Industry of Arizona", U.S. Bureau of Mines, January 1982

p/ Preliminary
NA Not available
W Withheld to avoid disclosing company proprietary data; value included in "Combined Value" figure.
XX Not applicable.
1/ Production was measured by mine shipments, sales, or marketable production (including consumption by producers).

TABLE IX

ARIZONA MINE PRODUCTION (RECOVERABLE) OF GOLD, SILVER, COPPER, LEAD AND ZINC IN 1981

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 2/	7	1,683	204		W	W	W
Gold-Silver	3	14,851	1,850	110,848 3/	-	-	-
Silver	10	122,596	367	203,601	W	W	W
Total	19	139,130	2,421	324,449	W	W	W
Copper	28	216,787,430	95,496	7,565,368	1,071,949 4/	1,095 3/	152 3/
Lead	2	3,937	9	1,907	W	W	W
Total	30	216,791,367	95,505	7,567,275	1,071,949 5/	1,095 3/	152 3/
Other Lode material:							
Gold-silver tailings 6/	1	174,447	2,413	173,507	68	W	-
Copper precipitates	6	124,262	-	-	75,269	-	-
Total 7/	7	298,708	2,413	173,507	75,339	W	-
GRAND TOTAL 7/	49	217,229,204	100,339	8,055,231	1,147,068	1,095	152

Source: "Minerals Yearbook - Area Reports; Domestic 1981," U.S. Bureau of Mines (Preliminary data)

W With held to avoid disclosing company proprietary data.

1/ Data will not add to total shown because some mines produce more than one class of material. Operations from which metals are recovered only from tailings or precipitates are not counted as producing mines.

2/ Includes material that was leached.

3/ Includes columnar data indicated by symbol "W" to avoid disclosing company proprietary data.

4/ Includes copper recovered from precipitates of ore leached.

5/ Does not include copper from lead ore.

6/ Combined to avoid disclosing company proprietary data.

7/ Data may not add to totals shown because of independent rounding.

TABLE X

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

OPERATOR	MINE	CAPACITY
Phelps Dodge	Morenci	155,000
Anamax	Twin Buttes	135,000 2/
Magma	San Manuel	130,000
Kennecott	Ray	114,000
Duval	Sierrita	102,000
Cities Service	Pinto Valley	85,000
Cyprus	Bagdad	76,000
Phelps Dodge	Metcalf	65,000
Inspiration	Inspiration Area	55,000
Phelps Dodge	New Cornelia	45,000
Cyprus	Pima	45,000
Magma	Superior (Magma)	42,500
ASARCO 3/	Mission	35,000
ASARCO	Silver Bell	23,500
Duval	Esperanza	22,500
ASARCO	Sacaton	22,000
Noranda	Lakeshore	21,000
Duval	Mineral Park	17,000
ASARCO 3/	Eisenhower	13,000
ASARCO 3/	San Xavier	9,000
Inspiration	Christmas	8,500
Ranchers	Bluebird	8,000
Cities Service	Miami	6,000
Cyprus	Johnson	5,500
Phelps Dodge	Copper Queen/Lavender	3,500
Inspiration	Ox Hide	2,500
Cities Service	Copper Cities	2,000
	TOTAL	1,248,500

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 leach plant 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 33,000 tons of copper concentrated annually from ore obtained at the Eisenhower mine.

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

TABLE XI

MINE PRODUCTION OF RECOVERABLE COPPER IN THE UNITED STATES

(Short Tons)

STATE	1980	Rank in 1980	1981 3/	Rank in 1981
ARIZONA	834,787	1	1,143,297	1
COLORADO	508	7	W	
IDAHO	3,420	6	3,879	6
MISSOURI	14,965	5	9,449	5
MONTANA	41,611	4	68,252	4
NEW MEXICO	164,677	3	169,979	3
UTAH	173,913	2	229,081	2
OTHER STATES 1/	53,948		61,487	
TOTAL 2/	1,287,829		1,685,424	

Source: "Minerals Yearbook - Metal, Minerals, 1980", U.S. Bureau of Mines; Copper in 1981 - Preliminary", U.S. Bureau of Mines.

1/ Includes California, Michigan, Nevada and Tennessee (1980); and California, Maine, Michigan, Nevada, Oregon, Tennessee and Washington (1981).

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

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/
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
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
1981	26,031	687,434,798	26,408	507.85	216,787,430

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 the 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 1981.

TABLE XIII

ARIZONA INDUSTRIES COVERED BY SOCIAL SECURITY

YEAR - 1981

Industry	Average Number of Employees 1/	Total Wages	Average Annual Wage	Average Weekly Wage
Copper Mining	21,980	579,393,826	26,360	506.92
Copper Smelting, Refining & Rod Fabrication	4,051	108,040,972	26,670	512.89
TOTAL COPPER MINING & PROCESSING	26,031	687,434,798	26,408	507.85
Other Mining, Quarrying & Processing	3,051	76,946,142	25,219	485.00
ALL MINING, QUARRYING & PROCESSING	29,082	764,380,940	26,283	505.45
Mfg. Except Copper Processing	155,903	2,976,138,354	19,089	367.11
Construction	72,120	1,391,913,411	19,299	371.15
Transp., Utilities, etc. 2/	49,252	1,075,868,161	21,844	420.08
Wholesale-Retail Trade	253,619	2,805,983,755	11,063	212.76
Services, Finance & Misc.	266,258	3,509,878,067	13,182	253.50
Agriculture & Related Services	24,838	254,534,993	10,247	197.07
Federal, State & Local Government	187,366	3,025,408,962	16,147	310.52
TOTAL AND AVERAGES	1,038,438	15,804,106,643	15,219	292.68

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/

Period	All Employees		PRODUCTION WORKERS											
	Average No. (Thousands)		Average No. (Thousands)		Average Weekly Earnings		Average Weekly Hours		Average Hourly Earnings		Average Earnings Per Man Per Year		Aggregate Man-Hours (Thousands)	
	2/ Ariz.	3/ U.S.	4/ Ariz.	5/ U.S.	Ariz.	U.S.	Ariz.	U.S.	6/ Ariz.	U.S.	7/ Ariz.	U.S.	8/ Ariz.	U.S.
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
1981	21.9	36.2	17.4	27.9	497.28	492.54	41.2	41.6	12.07	11.84	25,859	25,612	37,278	60,353

-continued-

TABLE XIV CONTINUED

EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING
IN THE UNITED STATES AND ARIZONA

Period	Copper Ore Mined (Thousand Short Tons)		Copper Produced (Recoverable Content) (Thousand Pounds) 10/		Worker Productivity: Copper Ore Mined per man-hour (Tons)		Worker Productivity: Copper Produced per man-hour (Pounds)	
	Ariz.	U.S.	Ariz.	U.S.	Ariz.	U.S.	Ariz.	U.S.
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	263,722	1,965,072	2,955,210	6.131	4.713	67.607	52.817
1979	203,977	291,878	2,085,556	3,140,110	6.061	5.369	61.971	57.759
1980	169,650	241,090	1,669,495	2,527,920	5.588	5.004	54.994	52.465
1981	216,787	306,089	2,294,437	3,354,548	5.815	5.072	61.549	55.582

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.

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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 bench marks.

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 includes ore shipped directly to smelters, treated by concentration, and ore leached in heaps, vats or tanks.

10/ Copper produced includes recoverable copper from copper ore (see 9/) and from copper precipitates and cathodes produced from dump and in-place leaching.

TABLE XV

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
Anamax Mining Company	Helvetia	Sulfide	320	0.64	Publ. 1973; cutoff at 0.3% Cu
	Helvetia	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.
	Twin Buttes	Sulfide	294	0.65	Publ. in Amax Inc. 1981 Form 10-K.
	Twin Buttes	Oxide	37	0.94	Publ. in Amax Inc. 1981 Form 10-K.
ASARCO Inc.	Mission	Sulfide	89.563	0.76	With .14 Ag oz/ton. Publ. ASARCO 1931 Annual Report.
	Poston Butte	Mixed		0.47	32-42 million tons possible. Publ. E&MJ 1972.
	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	163.695	0.52	With .06 oz/ton Ag. Publ. in 1981 Annual Report.
	Silver Bell	Sulfide	22.712	0.68	With .07 oz/ton Ag. Publ. in 1981 Annual Report.
	Silver Bell	Oxide			
AZTEC MINING CORP.	Mame	Oxide	2	1.00	Unpublished estimate.
BS&K MINING COMPANY	Atlas	Mixed			
CASA GRANDE COPPER COMPANY	Casa Grande	Mixed	352	1.00	Publ. in Getty Oil Co. 1980 Annual Report
CF&I STEEL CORP.	Dragoon	Oxide			

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
CITIES SERVICE COMPANY	Cactus	Oxide			
	Copper Cities	Oxide			
	Miami	Oxide			
	Miami East	Mixed (?)	6.0	3.14	1981 Communication with company.
	Old Dominion	Sulfide			
	Pinto Valley	Sulfide	398.6	0.411	Publ. in 1981 Annual Report. Included probable ore.
COCHISE DEV. GROUP	Bisbee-North	Mixed (?)	20	0.80	Unpublished estimate.
COCHISE MINING CORP.	San Juan	Oxide	20	0.50	Unpublished estimate.
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.
	Bagdad	Oxide	38	0.33	Acid soluble Cu.
	Bagdad	Oxide	97	0.19	Stockpile; acid soluble Cu after prior leaching. Above as of 5/3/79 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 estimate; with 0.02% Mo.
	Johnson	Oxide	6.643	0.50	Acid soluble Cu. Publ. in 1980 E&MJ International Directory.
	Pima	Sulfide	126.235	0.498	Publ. 1981 E&MJ International Directory.
DUVAL CORPORATION	Esperanza	Sulfide	48.783	0.27	With .034% Mo.
	Mineral Park	Sulfide	35.577	0.17	With .054% Mo.
	Sierrita	Sulfide	366.138	0.30	With .035% Mo. Above publ. in Pennzoil Co. 1981 Form 10-K.

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
EISENHOWER MINING CO.	Palo Verde (Anamax)	Sulfide	112.0	0.55	Published in AMAX 1981 Annual Report.
	Palo Verde (ASARCO)	Sulfide	35.043	0.74	With .14 oz/ton Ag. Published in ASARCO 1981 Annual Report.
EL PASO COMPANY	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 CONSOLIDATED COPPER COMPANY	Christmas (OP)	Sulfide	7.567	0.63	Publ. in Hudson Bay 1981 Annual Report.
	Christmas (OP)	Oxide			
	Christmas (UG)	Sulfide	20.131	1.78	Includes "probable" ore. Publ. in Inspiration 1980 Annual Report.
	Inspiration Area Mines	Mixed	220.673	0.51	Publ. in Hudson Bay 1981 Annual Report.
	Ox Hide	Oxide	29.309	0.31	Publ. in Inspiration 1979 Annual Report.
	Sanchez	Oxide	79.362	0.35	Publ. in Inspiration 1980 Annual Report.
KENNECOTT CORPORATION	Chilito	Mixed			
	Lone Star	Mixed	2000	0.41	Reported at Ariz. Conference AIME 12/77.
	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 CORPORATION	Red Mountain	Sulfide		0.71	Publ. 1970. 100 million tons possible.

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
KEYSTONE MINERALS INC.	Korn Kob	Oxide	8	0.50	Publ. in "Pay Dirt" July 1973
MAGMA COPPER COMPANY	Copper Creek	Sulfide			
	Kalamazoo & San Manuel	Sulfide	704.125	0.707	Publ. in Newmont Mining Corp. 1981 Annual Report
	Superior	Sulfide	4.962	5.52	Publ. in Newmont Mining Corp. 1981 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 CO.	Zonia	Oxide	20.5	0.53	Publ. in 1980 E&MJ International Directory.
NAVAJO TRIBE (?)	White Mesa	Oxide	2	0.75	Publ. 1955.
NORANDA LAKESHORE MINES INC.	Four Metals	Sulfide	3	0.82	Reported 1965
	Lakeshore	Sulfide (Porphry)	41	0.65	Published in Noranda's 1981 Annual Report
	Lakeshore	Sulfide (Tactite)	8.9	1.35	Published in Noranda's 1981 Annual Report
	Lakeshore	Oxide	16.6	1.17	Published in Noranda's 1981 Annual Report
	Ventura	Sulfide	6.3	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.

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
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			
	United Verde	Oxide			
	W. Copper	Mixed	350	1.0	Published in Pay Dirt Magazine, April 1981; by underground methods at depth of 1600 - 3300 feet.
RANCHERS EXPLORATION & DEVELOPMENT CO.	Bluebird	Oxide	65	0.53	Publ. in Ranchers' 1981 Annual Report.
V. B. SMITH ESTATE	Dynamite	Sulfide			
SQUAW PEAK MINING CO.	Squaw Peak	Sulfide	30	0.35	Unpublished estimate
STANDARD METALS CORP.	Antler	Sulfide	5.1	1.95	With 4.13% Zn, 0.94% Pb, & 1.05 oz Ag/ton. Publ. in 1978 Annual Report & Form 10-K.

TABLE XV CONTINUED

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
STRONG & HARRIS	Strong & Harris	Mixed	60	0.60	Unpublished estimate; with 0.70% Zn.
SUPERIOR OIL	Pine Flats	Sulfide	12	0.50	Unpublished estimate.
UNDETERMINED	Mineral Hill	Mixed			
UNION OIL	Turquoise	Oxide	10	0.50	Published 1975.
UNITED STATES GOVERNMENT	Park Hill	Mixed (?)	30	0.45	Unpublished estimate.
UNITED STATES GOVERNMENT & U.S. METALS CORP.	Apex	Mixed (?)			
VAN DYKE COPPER CO. & SHO-ME COPPER CO.	Van Dyke	Oxide	100	0.50	Published 1977.

1/ Reserves are given with a grade of average total copper content as of December 31, 1981, unless stated otherwise under "Remarks". As used in this table, reserves generally mean those estimated quantities of ore which, under presently and reasonably forseen technical and economic conditions may be profitably mined and sold or processed for the extraction of their constituent values.