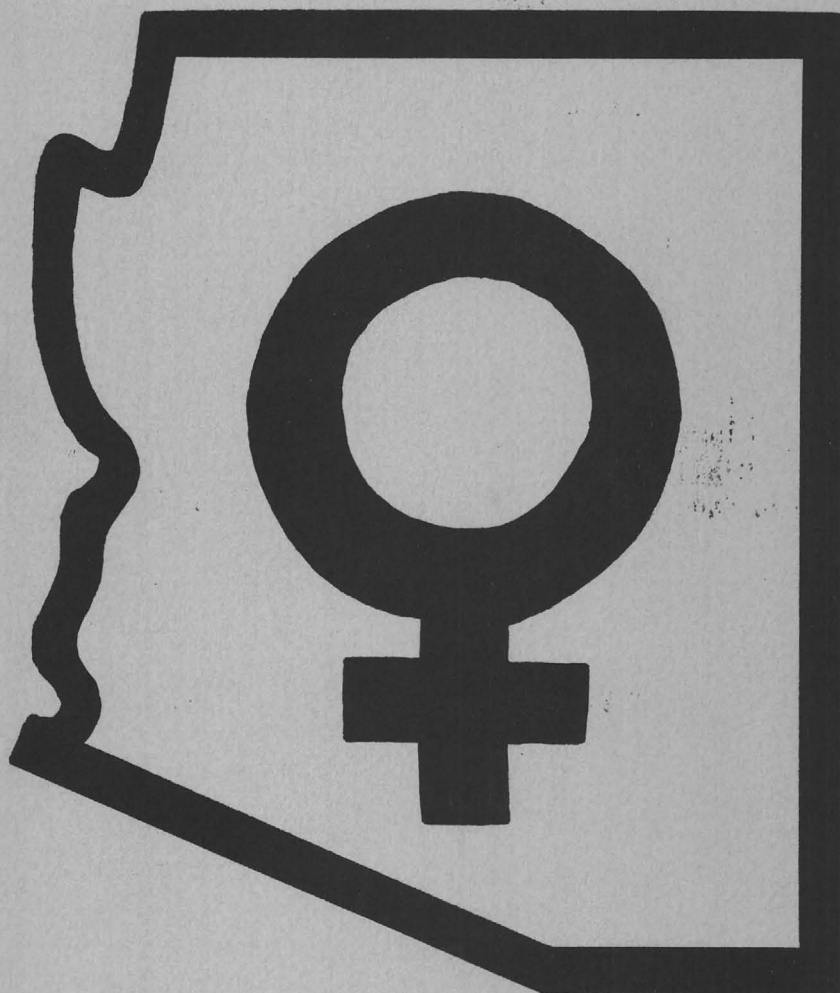


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**THE PRIMARY COPPER INDUSTRY  
OF ARIZONA  
IN  
1975 - 1976**

**SPECIAL REPORT NO. 2**



**BY**

**MICHAEL N. GREELEY**

**ARIZONA DEPARTMENT OF MINERAL RESOURCES**

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DECEMBER 1978

ARIZONA DEPARTMENT OF MINERAL RESOURCES  
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## INTRODUCTION

The Arizona Department of Mineral Resources presents herein a report on the copper industry. This report discusses the economic conditions that prevailed during 1975 and 1976 and specifically profiles Arizona's copper production during this period. A short resume of the operational highlights reported by individual developers and producers in the state is also given.

The statistical tables in this report include various production and employment figures through 1976. In addition, the tables are expanded with historical compilations of leach-copper as a percentage of primary production, average grade of ore produced, recoveries, stripping ratios, and designed copper capacity. A table and location map of copper reserves in Arizona is also provided. It is hoped that the information is useful to the reader and a sincere request is extended for any corrections or suggestions deemed necessary for the accuracy or completeness of this report.

The Department maintains an extensive library of information concerning the copper industry, including earlier editions of reports similar to this one. Another copper report, with compilations through 1977, will be issued in early 1979.



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1/ Throughout this report a "Ton" means a short ton (2000 pounds or 1.1023 metric ton).

## ECONOMIC CONDITIONS IN 1975 AND 1976

The recession of 1975 inflicted a great blow to the copper industry. In the United States, demand for copper was down 31% from 1974 and 38% from 1973. As demand dropped so did prices.

As 1975 opened the U. S. producer price was 68¢ per pound of copper. At the end of January Asarco led a general reduction to 63¢. Another cut to 60¢ per pound was instituted by Asarco and Phelps Dodge in June; other U. S. producers refused to lower their price. By late July, the market was slightly higher again and Asarco and Phelps Dodge rejoined the other producers at 63¢, where the price remained through the end of the year.

Although curtailments of mine production were initiated at many properties, the inventory of concentrates and refined copper increased enormously in 1975. There was a world excess, over normal levels, of approximately 800,000 tons of copper. In the U. S., production (including secondary recovery of unalloyed copper) exceeded consumption by about 15% (Table XIV). Primary refined stocks at U. S. refineries doubled during the year, rising from 101,000 tons to 207,000 tons (Table XVI). Net primary imports fell from almost 436,000 tons in 1974 to a little over 127,000 tons in 1975 (Table XV).

As the world and U. S. economies began to recover in 1976, consumers and commodity speculators took advantage of the low price. In late February, Cities Service raised its producer price from 63¢ to 66¢ but was the only supplier to do so. A week later, Cities Service reduced its price back to 63¢. But demand continued to strengthen and on March 19, Asarco, followed by other producers, raised its price to 66¢. In mid-April, Kennecott led another producer increase to 70¢. And again, in late June, Kennecott, and other producers, raised the price to 74¢ per pound.

Then a pause in the economic recovery set in and the copper market fell back to levels experienced in the 1975 recession. On October 6, Phelps Dodge led the producers with a reduction to 70¢ per pound and on December 1, Asarco led another reduction to 65¢, where the price remained until the end of 1976.

Many production curtailments at the mines were lifted during 1976 in response to increased demand. But, as the economy softened in the later part of the year, inventories of concentrates and refined copper continued to build throughout the free world. For 1976, U. S. primary production from mines and secondary recovery of unalloyed copper was slightly above consumption (Table XIV). A generally low free-market

price compared to the U. S. producer price presented a bargain to U. S. fabricators, and, as a result, net primary imports increased substantially over 1975 (Table XV). Zambia, a country that shipped little or no copper to the U. S. in 1975, exported over 127,000 tons of refined copper to this country in 1976. Substantial increases in imports were also recorded from Canada, Chile, Peru, and Yugoslavia. The primary refined stocks at U. S. refineries were reduced only slightly from the beginning of 1976, to 190,000 tons (Table XVI).

In summary, the copper industry, at least in the U. S., continued to lag behind other industry leaders as economic conditions generally improved. Consumption in the free world, including the U. S., increased from 1975. Production, however, at many foreign mines continued at a high rate, supplying the market with a surplus of low-cost copper. American producers found it difficult to compete effectively against these lower priced supplies; in fact many of them operated at a loss or break-even point.

The average annual price of copper per pound, at a high of 77¢ in 1974, declined to 64¢ in 1975 and rose slightly to 69¢ in 1976 (Table XVII).

## COPPER PRODUCTION IN ARIZONA

The center of copper production in the United States is Arizona. In 1975 the state accounted for 57.5% of the Nation's newly mined copper. In 1976, the year of America's Bicentennial observance and perhaps as a fitting tribute to the revolutionaries' early use of the red metal, Arizona produced for the first time over a million tons of copper and accounted for 63.8% of the total primary production in the U. S. (Tables XII and XVII). Indeed Arizona produced more copper than any country in the world, except Chile (Table XVIII).

In 1976 the gross value of mineral production in Arizona was \$1,726,621,000. Of this total value, copper production contributed 83% (Table VII). Other major contributors to the total mineral production of the state include molybdenum, gold, and silver. Virtually all the molybdenum and most of the gold and silver are byproducts of the treatment of copper ores (Table VI). As a result, Arizona ranks second in the United States in the production of molybdenum and silver, and fourth in the production of gold.

From a record employment high in 1974 of nearly 28 thousand persons working in the primary copper industry, the number of employees fell eight percent to approximately 25.6 thousand in 1976 (Tables XIX and XX). Employment and productivity figures for this same period, however, indicate the production worker's average hourly earnings rose roughly \$1.50 (from \$5.61/hr. to \$7.14/hr) as his average hourly production rate increased about one ton (from 4.5 tons/man-hr. to 5.4 tons/man-hr).

There were 29 major Arizona copper mines producing in 1975 (Table I). The number of operating properties was reduced to 27 in 1976. The newest property to begin operations was the Lakeshore underground mine which came on-stream in early 1976 and added significantly to the state's production.

Interestingly, there was a sharp rise in the amount of copper produced by leaching methods (Table II). The Johnson and Lakeshore mines began supplying leach-copper during the 1975-76 period and in 1976 copper produced by leaching oxide-type minerals exceeded 16% of the total primary production. Generally the cost of producing leach-copper has been less than producing milled sulfide concentrates.

Over the years, the average grade of ore produced has declined. Between 1966 and 1975, the copper content of sulfide ores dropped 30% to a point where there was only about 11 pounds of copper in a ton of ore mined (Table III). There was a slight reversal in this downward trend when in 1976 Arizona's ore averaged 12 pounds of copper per ton.



A review of the copper recoveries listed in Table IV indicates little or no change during the past decade. Although no attempt was made to weight the recoveries according to the amount of material treated, it is obvious that, for an operation to maintain its copper metal production with leaner ore feeds, significant technological refinements must have been made.

With the cessation of mining at the Copper Cities mine in 1975, the number of open pit operations declined to 20 in 1976. The stripping ratio, or the amount of waste removed in comparison to the amount of ore mined, at these operations is given for the past decade (Table V). Even though the average annual stripping ratio has not fluctuated greatly from what it was in 1966 (2.3:1), the ratio does appear to be creeping upward. In 1976 the average ratio was 2.7:1.

Table XI shows an estimate of the capacity to produce primary copper at each of the state's principal operations. In total there is a designed capacity to produce slightly more than 1.25 million tons annually. The Arizona mines and their concentrators and leach-plant facilities operated at about 65% capacity during 1975 as a result of a major recession in the industry. As market conditions improved, albeit erratically, in 1976, production was raised to about 80% of capacity.

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 socio-political factors that influence daily the decisions made by the developers and producers of copper. Foremost, however, 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 XXII.

An interesting development that recently improved the reserves held by Asarco should be mentioned. In 1976, an agreement signed with Anamax effectively unlocked over 200 million tons of ore. In addition to the new Palo Verde mine containing 156.5 million tons that will be developed by the partners, Asarco will extend the life of its Mission and San Xavier mines by adding to them 44.2 million tons. Moreover, there will be a significant improvement of ore grade at the Mission mine.

It should be emphasized that, although the reserves listed in Table XXII total more than 10 billion tons (generally as of December 31, 1977), 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.

## HIGHLIGHTS OF COMPANY OPERATIONS IN ARIZONA

The following is a resume of operational developments and accomplishments of major companies in Arizona concerned with production of copper.

### Anamax Mining Company

A three-year expansion program was largely completed at the Twin Buttes mine in 1975. A new solvent extraction-electrowinning plant built to treat oxide ore began operation in August. The expansion program increased annual capacity to approximately 90,000 tons of copper contained in concentrates and 36,000 tons of cathode copper.

Due mainly to unanticipated poor ground conditions which severely limited access to ore, the sulfide concentrating facility was shut down on March 1, 1975 and ore mining suspended while an intensive program of overburden removal was pursued. A major reduction in the planned angle of slope walls in certain portions of the orebody resulted in the elimination of some ore carried as reserve. A comparison of reserves published as of December 31, 1974 and 1975 shows that although the oxide tonnage was increased 15%, the sulfide tonnage was reduced by 80 million tons (426M tons to 346M tons). Fortunately the average grade of the sulfide ore was improved eight percent.

In July 1975, stripping operations were reduced to five days per week and the work force temporarily reduced. In January 1976, mining of ore was resumed and the sulfide concentrator renewed operations at a reduced rate of 30,000 tons of ore per day, for five days per week. Milling of ore from the northeast orebody was initiated during the first quarter. The reduced production schedule, approximately 60% of capacity, was maintained through the year. During this first full year of operation the oxide plant was the largest single producer of cathode copper from oxide ores in Arizona, producing 57,925,000 pounds.

### Asarco Inc.

Except for a three-week vacation shutdown, operations were normal at the Sacaton and San Xavier mines in 1975. Production at Sacaton during its first complete year of operation exceeded full capacity of 21,000 tons of copper. Development work began for the mining of the Sacaton East orebody by underground methods. A head frame and hoist house were installed at the surface and the main shaft was collared to bedrock. Mining of oxide ore from the south pit of the

San Xavier mine began at midyear; this ore is treated with the oxide ore obtained from the north pit at the San Xavier vat-leach plant.

A reduced operational schedule of five days per week continued from late 1974 through June 1975 at the Mission and Silver Bell mines. After a complete shutdown for a three-week vacation in July, work schedules were reduced further to four days per week. This production schedule, approximately 57 % of normal capacity, was maintained through the year.

The Hayden smelter operated at about 65% effective capacity during 1975. Installation of a sophisticated air monitoring and meteorological measurement system at the smelter was essentially completed and in full operation by December 1, 1975. This installation and major repair to one smelting furnace caused the reduced smelter production.

In 1976, operations at the Sacaton and San Xavier mines continued normally with the exception that development of the underground East orebody at Sacaton was suspended. Mining of oxide ore at the north pit of the San Xavier mine was completed during the year and shipment commenced of the underlying sulfide ore to the Mission concentrator. The south pit at San Xavier continued to contribute oxide ore to the vat-leach plant. Production levels at Mission and Silver Bell were finally restored to normal in August 1976.

During the year the smelter at Hayden again operated at about 65% capacity. Major repairs and modifications were made to the sulfuric acid plant originally built in 1971 to control sulfur dioxide emissions.

#### Big Hole Mining Company

Since 1954 production at the United Verde mine was contracted by Phelps Dodge, the owner, to the Big Hole Mining Company. Copper was produced from both sulfide and oxide ores. Operations at the mine were brought to a close in June 1975.

During its period of operation, Big Hole produced in excess of 25 million pounds of copper recoverable from sulfide ore alone. Between 1966 and 1975 the average (weighted) sulfide grade was 5.55 percent Cu.

#### Casa Grande Copper Company

An announcement of a major discovery of copper mineralization was made in late 1976 by the Getty Oil Company and Hanna Mining Company. These two companies were equal participants

in the joint exploration venture managed by the Coastal Mining Company, a subsidiary owned entirely by Hanna. The mineralization is in the vicinity of the Santa Cruz river drainage west of Casa Grande, Arizona, and occurs at depths of 1600 to 3300 feet. The deposit is only a few miles southwest of Asarco's Sacaton mine.

Eventually a new company, the Casa Grande Copper Company, was formed to further explore and develop the Casa Grande deposit. The new company is owned equally by Getty and Hanna.

#### Cities Service Company

During 1975, the first complete year of operation, the Pinto Valley mine and mill operated at about 90% of design capacity. Under normal conditions the facility should produce annually 62,500 tons of copper contained in concentrates. In addition, there is a molybdenum circuit. The open-pit mine will eventually encompass the old Castle Dome mine area.

Ore extraction at the Copper Cities and Diamond H open-pit mines was terminated on May 9, 1975. Milling of stockpiled low-grade material was stopped on September 12, 1975. Leaching of dumps, however, and production of precipitate-copper at the Copper Cities unit continued through the year.

In-situ leaching of the old Miami orebody and production of precipitate-copper also continued through 1975. A new solvent extraction-electrowinning plant to produce cathode copper directly from leach solutions was being constructed.

Poor economic conditions forced a postponement of production originally scheduled for early 1976 at the Miami East orebody. Underground development work, however, was conducted to verify mining conditions. In addition, a drilling program to assist in detailed planning of eventual ore extraction continued through the year.

In 1976 the Pinto Valley mine and mill operated at six percent over design capacity. Design modifications were begun to increase capacity from 40,000 tpd to 50,000 tpd. This expansion program was scheduled for completion in late 1978.

Leaching continued through 1976 at the Copper Cities and Miami units. The new solvent extraction-electrowinning plant went on stream during the second quarter of the year. The plant has a design capacity of 6,000 tons per year of high quality cathode copper.



The Miami East underground mine remained on standby during 1976. A test mine opening was excavated, however, and the development drilling program was completed.

#### Continental Oil Company

Conoco continued to evaluate its Poston Butte deposit approximately three miles northwest of Florence, Arizona. During 1975, underground work to obtain bulk ore samples, accumulate rock mechanics data, and confirm ore reserve estimates was completed. Also, all major operations were completed at a pilot recovery plant where performance and design criteria for oxide and sulfide ore treatment were determined.

In 1976, Conoco announced the indefinite postponement of development of the Poston Butte deposit. Comprehensive studies completed during the year, however, showed that the deposit can be developed by standard techniques of open-pit mining and ore processing.

#### Cyprus Mines Corporation

At Bagdad, a major expansion program begun in mid-1974 was on schedule throughout 1975. Approximately one third of the pre-production stripping was completed. Eleven of 20 new 170-ton trucks were operating by the end of 1975 as well as one of four new 20 cubic yard shovels. A new mine maintenance and machine shop and warehouse facilities were finished by July. Site preparation for the primary crusher and new concentrator was completed by the end of the year. New employee housing was under construction and drilling to expand reserves further was underway. In 1975, the Cyprus Bagdad Copper Company was the first company to receive certification of its electrowon cathodes for New York Commodity Exchange contracts.

During the year, Cyprus reduced costs and improved operational efficiency at the underground Bruce mine by putting into service a new, large mobile drilling machine. An intensive exploration program to delineate additional ore was not successful. The Johnson open-pit mine and solvent extraction-electrowinning plant went into production in March 1975. This operation is designed to produce approximately 5,000 tons of high quality cathode copper annually.

The Cyprus Pima Mining Company (owned 50.01 % by Cyprus Mines Corporation) produced at near capacity level during 1975. Fifteen new 170-ton trucks were delivered to the Pima mine by October.

During 1976 expansion at the Bagdad mine continued on schedule. Site preparation for the overland conveyor, water reservoir, and tailings dam was finished in the first quarter. Drilling to expand ore reserves continued.

Production in 1976 at the Bruce mine was difficult to maintain because of support problems in stopes which neared completion. It was reported that the mine had a life expectancy of a little more than one year, and that exploratory drilling had not increased reserves.

The Johnson operation completed its first full year of production in 1976 and produced above capacity. It was the second U. S. producer of electrowon cathodes to receive certification for New York Commodity Exchange contracts. Cyprus reported that at the current rate of production the mine had eight years of operation remaining after 1976.

The Cyprus Pima Mining Company again produced at near capacity level during 1976. A new large drill began operating in April, seven new 170-ton trucks were delivered in the third quarter, and a new 20 cubic yard shovel began working in December. Cyprus reported that after 1976 the Pima mine had a life expectancy of about eight years.

The CYMET process, a hydrometallurgical technique to reduce copper directly from copper sulfides, was tested and improved during 1976. The pilot plant is operated at the Pima mine site.

#### Duval Corporation

Operations at the Esperanza and Mineral Park mines were curtailed in February 1975 from a seven-day week to a five-day week. This curtailment reduced total copper production about 17%.

During the year, production at the Sierrita mine was essentially at full capacity. In addition to being the second largest producer of copper in Arizona during 1975, Sierrita was the single largest source of molybdenum in the state, producing 47 % of the total. By December, the total amount of copper required to be delivered to the General Services Administration had been made available for delivery. These final deliveries completed Duval's commitment to repay a GSA loan with 38-cent copper.

In February 1975, the construction of new facilities to produce ferro-molybdenum was completed. This plant, adjacent to the Esperanza property, is designed to produce 3.5 million pounds of ferro-molybdenum annually.

During the year, construction of the new CLEAR plant near the Sierrita property, was completed. This hydrometallurgical plant is designed to produce 40,000 tons of copper crystals (equivalent to a high-grade blister copper) per year. It will treat concentrates produced at the Esperanza and Sierrita properties and precipitates produced at the Esperanza and Mineral Park properties.

In 1976, operational curtailments imposed at Esperanza and Mineral Park were finally relaxed in September and the properties resumed a seven-day week. Sierrita again produced at full capacity; the mine produced 17,608,678 pounds of recoverable molybdenum, 57% of Arizona's total production.

The CLEAR plant commenced production during the first quarter of 1976. It operated at about 85% of design capacity during the year.

#### Eisenhower Mining Company

The Eisenhower Mining Company was formed in August 1976 as a general partnership between the Anamax Mining Company and Asarco Inc., to develop and mine the Palo Verde ore deposit. This ore body lies between Asarco's Mission and South San Xavier open-pit mines and is leased from the State of Arizona on claims located in the 1950's.

Stripping of overburden at the Palo Verde began in late 1976 and production will begin in early 1979. Asarco is the mine operator. Anamax's share of the ore will be concentrated at the Twin Buttes mill, Asarco's at the Mission mill. The planned production is 27,000 tons per year of copper contained in concentrates.

#### Hecla Mining Company

Hecla is the operating member of a general partnership formed with the El Paso Natural Gas Company to develop, mine, and produce copper at the Lakeshore underground mine. The mine and sophisticated plant facilities are designed to produce 65,000 tons per year of copper contained in cathodes and precipitates. The property is leased from the Papago Indian Tribe on a royalty basis. Preproduction mine development was 95% complete by the end of 1975.

Lakeshore began operations officially on April 1, 1976, although the first cathode-copper shipment was made earlier on January 26, 1976. Oxide ore production reached full capacity in August 1976. Production of sulfide ore was difficult to maintain at full capacity, however, because of dilution

problems. Although all plant facilities operated according to expectations except the copper precipitate pelletizing plant, the high start-up costs, low mine production rates, and low copper prices resulted in substantial losses for the year.

#### Inspiration Consolidated Copper Company

Overall production by Inspiration was curtailed 25% in February 1975. Another reduction in October brought production down to about 65% of capacity.

At the beginning of the year, the Inspiration Area mines were operated seven days per week and were producing all three major classes of ore, oxide, sulfide, and a mixture of the two (dual process), at the rate of 27,500 tpd. In February the work week was reduced to five days; however, the production rate was maintained. In April the seven-day week was resumed but production was reduced to 20,000 tpd. Mining of oxide ore was stopped at this time. In October, the work week was again reduced to five days and production was maintained at 20,000 tpd for the rest of the year.

Similar curtailments were imposed at the other operations. At the Christmas mine the work week was reduced in February from seven days to five days and there were complete shutdowns from November 24, to December 7, and from December 20, to the end of the year. Operations were reduced throughout the year at the Ox Hide mine from 20 shifts to 10 shifts per week.

There were intermittent shutdowns at the smelter and acid plant due to repairs of pollution control facilities. The failure of a furnace wall at the smelter caused a major halt of production from December 19, to January 21, of the following year (1976). Operations at the fabricating division were also reduced during the year from three shifts to two shifts per day, with a five-day week.

On the brighter side, in June 1975, the Inspiration smelter passed required air quality tests and was issued an operating permit by the Arizona State Department of Health Services. In addition, a new method of dump leaching that increases rate of copper extraction and recovery was developed, tested and put into practice late in the year. In June, Inspiration sold 850,000 shares of common stock to the Hudson Bay Mining and Smelting Company, Ltd., of Canada, and the Minerals and Resources Corporation, Ltd., of Bermuda, for \$31,450,000.

In 1976, most of the company's mining operations were at about 70% of capacity. The Inspiration Area mines maintained a production rate of 20,000 tpd on a schedule of five days per week. The Christmas mine resumed operations on January 20, with a five-day week until August when work was scheduled seven days per week. A work schedule of 10 shifts per week continued at the Ox Hide mine. In July, operations at the fabricating division were increased to 14 shifts per week and then reduced again in early September to 10 shifts per week.

Production records were set in 1976 at both the acid plant and the smelter. The smelter produced 127,000 tons of copper.

#### Kennecott Copper Corporation

On February 16, 1975, operations at the Ray Mines Division were reduced to a five-day week. There was a 12-week shutdown during the summer. The reverberatory furnace at the Hayden smelter was rebuilt during this shutdown. An expansion project to increase silicate copper leaching capacity by 40% continued at a reduced rate.

In 1976, although production schedules remained below full capacity levels, a substantial increase in copper production was realized. In addition, the expansion of capacity at the silicate copper leaching facility was completed early in the year and overall performance of the new plant exceeded design projections.

Kennecott reported that operations at Ray should continue for 70 years at current production levels. Engineering plans progressed during the year in anticipation of possible expansion of production capacity.

During 1975 and 1976, evaluation of the company's Safford deposit continued. Experiments were performed to test the applicability of a solution mining process on the deposit.

#### McAlester Fuel Company

McAlester began production of leach-copper at the Zonia mine in 1966. Oxide ore was taken from the open-pit mine and heap leached until 1973 when operations were changed and the deposit was leached in place. Slightly more than 31 million pounds of copper were produced before operations were suspended in March 1975.



### Newmont Mining Corporation

Production during 1975 at the San Manuel division was reduced by 23% with a temporary reduction in the work force. Nevertheless, it remained the largest underground metal mining operation in the U. S. and it was the largest single producer of copper in Arizona. It produced 187,487,000 pounds of recoverable copper during the year. Production at the high-grade Magma (Superior) mine was increased 33%.

During 1975, equipment and storage facilities were installed at the San Manuel smelter to utilize oil as smelter fuel during periods of natural gas scarcity. Subsequently, as the cost of oil rose, plans were drawn to modify the installations so that coal could be used as the primary fuel.

During 1976, the San Manuel mine continued to operate at a curtailed level. At mid-year, a gradual step-up of mine development was started but later, in view of recurrent unfavorable market conditions, the development work was again temporarily reduced. Production at the Magma mine was maintained at full capacity.

An abnormally high number of intermittent curtailments required for air pollution control at the San Manuel smelter adversely affected operations during the fourth quarter. The curtailments caused deterioration in the physical condition of the reverberatory furnaces and consequent lower efficiencies and throughput. As a result, concentrate inventories were built above normal and copper had to be purchased to meet sales obligations. During the year, however, the smelter did process old slag, enhancing substantially the total copper production.

The ammonia double alkali gas-scrubbing pilot plant at San Manuel continued operating during 1976. This plant was established by the Smelter Control Research Association, of which Newmont is a founding member.

### Occidental Petroleum Corporation

For several years Occidental's mineral division, Occidental Minerals Corp. (Oxymin), has drilled and delineated the Van Dyke oxide copper deposit that lies beneath much of the town of Miami, Arizona. The mineralization is 1100 to 2000 feet deep and varies from about 100 feet to 370 feet thick. In 1976, the company began preparations to test an in-situ copper solution mining process.

### Oracle Ridge Mining Partners

The Oracle Ridge mine, formerly known as the Control mine, is in the vicinity of Marble Peak on the northeast slope of the Santa Catalina Mountains. Between 1968 and 1974, the Continental Copper Co., a subsidiary of the Continental Materials Corp., drilled and defined the ore reserves on the property, began underground development, ran metallurgical tests and initiated feasibility studies.

In 1975, the company continued underground development and engineering studies for a comprehensive operating plan. Negotiations for the acquisition of rights-of-way and tailings storage area were made during the year and discussions were held with several companies interested in becoming a partner in the mine development.

During 1976, the general mine plan was completed and a second mine adit established. The underground development work was continued and a ventilation shaft begun. In August, an announcement was made that Union Miniere, S. A., a Belgium-based natural resources company had agreed in principle to take a 45% interest, in exchange for investing additional capital and arranging for necessary financing. Eventually, a new company, 55% owned by Continental and named the Oracle Ridge Mining Partners, was formed with Union Miniere to bring the mine into production.

### Phelps Dodge Corporation

The new Metcalf mine and concentrator began production in January 1975. Operations during the year showed that the concentrator, designed to treat 30,000 tpd, has an actual capacity of 40,000 tpd.

Work schedules at the Metcalf, Morenci, and New Cornelia mines and concentrators were reduced on January 9, from the equivalent of a 5½-day week to a 5-day week. On February 20, operations at these mines, as well as the underground mines at Bisbee, were reduced further to a four-day week. On June 13, 1975, the underground mines at Bisbee were shut down. During the week of July 13, operating schedules equivalent to a five-day week were resumed at the other properties and continued through the year.

Despite these operational curtailments and closure of the Bisbee mines, Phelps Dodge remained the leading producer of copper in Arizona. The company produced 345,688,981 pounds of recoverable copper, approximately 21% of the state's total production.

Installation of facilities to control air quality at the company smelters was essentially completed in 1975. Operations were generally on a seven-day week schedule except from February 20, to mid-July and during the three-week vacation shutdown at Morenci and New Cornelia.

The second of two units designed to dispose of most of the sulfuric acid produced at the Morenci smelter was completed and put in operation in November 1975. These facilities are used in leaching concentrator tailings produced at Metcalf and Morenci.

Construction of underground and surface installations and other development work at the company's Dos Pobres deposit near Safford, Arizona, continued during 1975. The No. 1 shaft was deepened about 240 feet to a final depth of 2,150 feet and the No. 2 shaft reached a depth of 1,439 feet.

In March 1976, work schedules at Metcalf, Morenci, and New Cornelia were increased to a six-day week. This schedule continued until December when it was reduced to the equivalent of a  $5\frac{1}{2}$ -day week. Operations at the smelters were generally on a seven-day week schedule except during the normal three-week vacation shutdown at Morenci and New Cornelia.

Mine production of copper was greater than in any prior year resulting from longer work schedules and greater production from the new Metcalf mine. In 1976, Phelps Dodge produced 475,731,242 pounds of recoverable copper from its Arizona mines, about 23% of the state's total production.

Development of the Dos Pobres deposit continued at a reduced rate in 1976. Most of the work was on underground access and haulage drifts around the extremities of the orebody. Sinking of the No. 2 shaft was suspended on February 15, when a depth of 1,570 feet was reached.

#### Ranchers Exploration and Development Company

During 1975 and 1976, the Bluebird property was operated essentially at full capacity. A record production of 17,875,534 pounds of cathode copper was obtained in 1976. Four new 120-ton ore trucks were purchased during 1976 to reduce mining costs as haulage distances and lifts increase.

In-place leaching and production of copper precipitates at the Old Reliable mine were suspended in July 1975.

TABLE I

## COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

Company Mine	1975			1976		
	Tons Copper Ore Mined	Pounds Recoverable Copper	Pounds Recoverable Molybdenum	Tons Copper Ore Mined	Pounds Recoverable Copper	Pounds Recoverable Molybdenum
<u>ANAMAX:</u>						
Twin Buttes	2,307,331	18,306,894	273,228	8,851,000	133,396,000	1,223,000
Cathode Cu		13,461,772			57,925,000	
Total	<u>2,307,331</u>	<u>31,768,666</u>	<u>273,228</u>	<u>8,851,000</u>	<u>191,321,000</u>	<u>1,223,000</u>
<u>ASARCO</u>						
Silver Bell	2,541,900	28,037,459		3,076,400	35,939,534	
Precipitate Cu		8,496,533			8,627,066	
Mission	5,089,800	53,891,133	432,304	6,407,300	70,380,563	268,679
San Xavier						
Precipitate Cu	1,368,600	19,384,305		1,317,400	22,771,705	
Sacaton	3,606,400	43,835,162		3,781,800	44,042,241	
Total	<u>12,606,700</u>	<u>153,644,592</u>	<u>432,304</u>	<u>14,582,900</u>	<u>181,761,109</u>	<u>268,679</u>
<u>CITIES SERVICE -</u>						
<u>MIAMI OPERATIONS</u>						
Miami-Copper						
Cities Operations						
Copper Cities 1/	1,670,090	19,055,546	19,760			
Precipitate Cu		3,561,559			3,370,154	
Miami						
Precipitate Cu		13,075,798			6,036,812	
Cathode 2/					7,472,083	
Pinto Valley Opns. 3/	13,895,820	107,498,466	159,136	15,630,585	128,743,605	440,643
Total	<u>15,565,910</u>	<u>143,191,369</u>	<u>178,896</u>	<u>15,630,585</u>	<u>145,622,654</u>	<u>440,643</u>

TABLE I (Continued)

## COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

Company Mine	1975			1976		
	Tons Copper Ore Mined	Pounds Recoverable Copper	Pounds Recoverable Molybdenum	Tons Copper Ore Mined	Pounds Recoverable Copper	Pounds Recoverable Molybdenum
<u>CYRUS MINES:</u>						
Bagdad	2,082,099	23,599,989	716,792	2,043,988	20,983,134	652,590
Cathode Cu		14,320,802			14,606,474	
Bruce 4/	94,609	6,536,000		90,278	5,889,420	
Pima	19,630,974	154,541,515	1,814,263	19,554,407	154,986,103	1,906,318
Johnson 5/						
Cathode Cu	1,709,804	6,143,024		1,311,590	10,059,608	
Total	<u>23,515,486</u>	<u>205,141,330</u>	<u>2,531,055</u>	<u>23,000,263</u>	<u>206,524,739</u>	<u>2,558,908</u>
<u>DUVAL:</u>						
Esperanza	5,490,362	24,914,864	3,194,830	5,486,238	28,623,378	2,986,930
Precipitate Cu		3,960,323			6,412,177	
Mineral Park	5,573,875	27,472,411	2,781,954	4,726,075	19,498,473	2,645,471
Precipitate Cu		6,915,242			6,817,415	
Sierrita	<u>31,430,788</u>	<u>186,727,062</u>	<u>13,286,923</u>	<u>34,022,842</u>	<u>202,927,887</u>	<u>17,608,678</u>
Total	<u>42,495,025</u>	<u>249,989,902</u>	<u>19,263,707</u>	<u>44,235,155</u>	<u>264,279,330</u>	<u>23,241,079</u>
<u>HECLA MINING COMPANY:</u>						
Lakeshore Mine 6/						
Sulfide Ore				1,209,340	18,426,880	
Oxide Ore				<u>1,410,228</u>	<u>28,407,483</u>	
Total				<u>2,619,568</u>	<u>46,834,363</u>	



TABLE I (Continued)

## COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

Company Mine	1975			1976		
	Tons Copper Ore Mined	Pounds Recoverable Copper	Pounds Recoverable Molybdenum	Tons Copper Ore Mined	Pounds Recoverable Copper	Pounds Recoverable Molybdenum
<b>INSPIRATION:</b>						
Inspiration	6,288,363	68,527,498		4,610,227	51,193,292	
Precipitate Cu		21,266,570			20,677,690	
Christmas Division	1,403,835	11,729,139		1,558,165	13,942,431	
Ox Hide Mine	2,302,230	10,107,194		2,189,565	7,915,445	
Total	<u>9,994,428</u>	<u>111,630,401</u>		<u>8,357,957</u>	<u>93,728,858</u>	
<b>KENNECOTT:</b>						
Ray	6,692,267	86,516,592	330,032	10,243,750	136,258,061	743,037
Precipitate Cu		24,338,397			24,374,253	
Total	<u>6,692,267</u>	<u>110,854,989</u>	<u>330,032</u>	<u>10,243,750</u>	<u>160,632,314</u>	<u>743,037</u>
<b>McALESTER FUEL COMPANY:</b>						
Zonia Mine 7/						
Precipitate Cu		619,263				
Total		<u>619,263</u>				
<b>MAGMA:</b>						
San Manuel	16,778,247	187,487,000	3,182,298	15,016,263	176,115,000	2,616,237
Reprocessed smelter slag				2,818,353	42,334,000	
Superior	1,087,694	78,048,000		971,109	79,791,000	
Reprocessed smelter slag				19,588	138,000	
Total	<u>17,865,941</u>	<u>265,535,000</u>	<u>3,182,298</u>	<u>18,825,313</u>	<u>298,378,000</u>	<u>2,616,237</u>

TABLE I (Continued)

## COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

<u>Company</u> <u>Mine</u>	1975			1976		
	<u>Tons</u> <u>Copper Ore</u> <u>Mined</u>	<u>Pounds</u> <u>Recoverable</u> <u>Copper</u>	<u>Pounds</u> <u>Recoverable</u> <u>Molybdenum</u>	<u>Tons</u> <u>Copper Ore</u> <u>Mined</u>	<u>Pounds</u> <u>Recoverable</u> <u>Copper</u>	<u>Pounds</u> <u>Recoverable</u> <u>Molybdenum</u>
<u>PHELPS DODGE:</u>						
Morenci Branch						
Morenci Mine	16,173,658	177,767,689		18,705,450	208,986,329	
Metcalf Mine <u>8/</u>	5,556,145	58,389,398		11,327,506	105,316,201	
Precipitate Cu		23,777,527			53,136,295	
New Cornelia Branch	7,270,059	66,045,992		9,481,855	100,399,483	
Copper Queen Branch						
Lavender Pit <u>9/</u>						
Precipitate Cu <u>10/</u>		8,376,532			7,892,934	
Copper Queen Mine <u>11/</u>	108,167	11,331,843				
Total	<u>29,108,029</u>	<u>345,688,981</u>		<u>39,514,811</u>	<u>475,731,242</u>	
<u>RANCHERS EXPLORATION AND</u> <u>DEVELOPMENT CORPORATION:</u>						
Bluebird Mine						
Cathode Cu	4,375,485	15,121,572		3,449,771	17,875,534	
Old Reliable <u>12/</u>						
Precipitate Cu		466,506				
Total	<u>4,375,485</u>	<u>15,588,078</u>		<u>3,449,771</u>	<u>17,875,534</u>	
TOTAL						
LARGE COMPANIES <u>13/</u>	<u>164,526,602</u>	<u>1,633,652,571</u> <u>14/</u>	<u>28,312,423</u>	<u>189,311,073</u> <u>15/</u>	<u>2,082,689,143</u> <u>14/</u>	<u>31,091,583</u>

Source: Arizona Department of Mineral Resources

TABLE I (Continued)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

- 1/ Copper Cities open-pit mine shutdown May 9, 1975, however, leaching operations continued through 1976.
- 2/ Cities Service's new solvent extraction-electrowinning plant came on stream in May, 1976.
- 3/ Pinto Valley's initial start-up was in July, 1974.
- 4/ Cyprus Bruce Copper and Zinc Company's copper production from copper-zinc ore. The Company's zinc production for 1976 amounted to 19,376,966 pounds of zinc.
- 5/ ~~Cyprus~~ Johnson came on-stream March 15, 1975.
- 6/ The Lakeshore mine came on-stream early in 1976.
- 7/ No production since March 1975.
- 8/ Phelps Dodge's Metcalf mine and concentrator began production in January 1975.
- 9/ The Lavender Pit and Bisbee concentrator operations were terminated December 14, 1974. However, leaching operations continued through 1976.
- 10/ This figure represents production from the dumps, the Lavender Pit and the Copper Queen mine.
- 11/ Phelps Dodge's Bisbee underground mines ceased operations on June 13, 1975, thus ending approximately 100 years of production. However, leaching operations continued through 1976.
- 12/ Leaching operations at Old Reliable were suspended July, 1975.
- 13/ 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 IX & X. Specific comparisons may differ due to times and methods of reporting.
- 14/ Includes 142,636,824 pounds of copper produced in 1975 and 259,820,353 pounds of copper produced in 1976 from material not classified generally as ore (see detail by company in this table). A more detailed, recent, historical record of leach production only is given in Table II.
- 15/ Includes 2,837,941 tons of smelter slag reprocessed by Magma (see detail in this table).

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

<u>Property</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Bagdad <u>2/</u>	11,066	14,258	14,781	7,281	14,681	13,391	14,267	13,508	14,321	14,606
Bisbee <u>3/</u>	4,443	7,285	7,002	7,407	8,345	10,000	8,532	6,402	8,377	7,893
Bluebird <u>4/</u>	7,690	1,449	9,921	11,520	12,458	14,680	15,005	15,344	15,122	17,876
Castle Dome	2,122	2,431	1,831	934	-	-	-	-	-	-
Copper Cities	2,792	4,356	3,799	4,491	4,376	4,577	4,570	3,295	3,562	3,370
Emerald Isle	275	1,611	4,180	3,713	3,822	3,629	2,180	-	-	-
Esperanza	6,132	4,478	3,619	4,428	4,454	2,094	2,268	1,817	3,960	6,412
Inspiration	27,969	30,930	45,108	48,097	45,588	56,487	50,401	47,765	52,470	45,545
Johnson	-	-	-	-	-	-	-	-	6,143	10,060
Lakeshore	-	-	-	-	-	-	-	-	-	28,407
Miami	8,726	11,077	13,756	14,965	12,806	12,170	11,988	11,969	13,076	13,509
Mineral Hill	-	4,901	2,887	-	-	-	-	-	-	-
Mineral Park	7,005	7,051	6,221	7,710	7,315	8,936	6,431	6,801	6,915	6,817
Morenci	27,780	23,162	22,754	16,950	14,188	24,493	25,668	22,704	23,778	53,136
Old Reliable	-	-	-	-	-	-	5,992	2,175	467	-
Ox Hide	-	744	7,243	13,298	7,962	9,673	8,950	9,679	10,107	7,915
Peacock	-	-	-	NA	NA	NA	NA	NA	NA	NA
Ray <u>5/</u>	21,188	21,742	29,968	43,971	31,622	31,472	28,369	25,478	24,338	24,374
Red Hills	-	-	-	-	46	-	-	-	-	-
San Xavier	-	-	-	-	-	-	4,955	11,762	19,384	22,772

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

<u>Property</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Silver Bell <u>6/</u>	5,017	4,909	5,226	5,614	6,297	7,897	8,092	7,860	8,497	8,627
Twin Buttes	-	-	-	-	-	-	-	-	13,462	57,925
United Verde	190	307	248	232	165	140	214	44	32	-
Zonia	3,264	3,928	3,576	4,456	4,769	4,778	2,991	2,717	619	-
<b>TOTAL</b>	<u>135,659</u>	<u>144,619</u>	<u>182,120</u>	<u>195,067</u>	<u>178,894</u>	<u>204,417</u>	<u>200,873</u>	<u>189,320</u>	<u>224,630</u>	<u>329,244</u>

PERCENT OF PRIMARY COPPER PRODUCED <u>7/</u>	13.5	11.5	11.4	10.6	10.9	11.2	10.8	11.0	13.8	16.1
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Source: Arizona State Dept. of Mineral Resources

- 1/ Copper recovered from precipitate and/or by solvent extraction from material dump, heap, vat or in situ leached.
- 2/ Precipitation replaced by solvent extraction in 1971
- 3/ Lavender Pit and Copper Queen
- 4/ Precipitation replaced by solvent extraction in 1969
- 5/ Includes only copper contained in precipitates from dump leaching. Does not include copper produced by electrowinning.
- 6/ San Xavier discontinued production of Siliceous Flux and commenced production of copper precipitate as of 5/1/73.
- 7/ Leach copper compared to total copper produced from all primary sources as reported in "Minerals Yearbook-Area Reports: Domestic", U. S. Bureau of Mines.

NA Not Available

TABLE III

AVERAGE CU CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES  
(Percent Total Copper)

<u>MINE OPERATION</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
ANAMAX MINING CO.											
Twin Buttes											
Sulfide	-	-	-		1.24	0.99	0.98	0.82	0.63	0.60	1.12
Oxide	-	-	-	-	-	-	-	-	-	1.27	1.31
ARIZONA RANCH & METALS CO.											
Mineral Hill											
Oxide	-	-			-	-	-	-	-	-	-
ASARCO INC.											
Mission											
Sulfide	.90	.88	.70	.67	.67	.67	.61	.60	.61	.60	.62
Sacaton											
Sulfide	-	-	-	-	-	-	-	-	.63	.74	.71
San Xavier											
Sulfide	-	-	-	-	-	-	-	-	-	-	-
Oxide	-	-	-	-	-	-	-	-	-	-	-
- Cu-bearing Silica Flux Mined 1968-72								.61	.77	1.05	1.12
Silver Bell											
Sulfide	.83	.79	.86	.70	.68	.65	.60	.64	.65	.72	.72
Oxide											
BIG HOLE MINING CO.											
United Verde											
Sulfide	4.9	5.2	5.4	6.4	6.3	5.2	4.9	5.1	4.8	5.7	-
Oxide											-



TABLE III (Continued)

AVERAGE CU CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES  
(Percent Total Copper)

<u>MINE OPERATION</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
CITIES SERVICE CO.											
Castle Dome											
Oxide						-	-	-	-	-	-
Copper Cities											
Sulfide							(.50)			(.50)	-
Oxide											
Miami											
Oxide											
Pinto Valley											
Sulfide	-	-	-	-	-	-	-	-		(.45)	(.45)
CYPRUS MINES CORP.											
Bagdad											
Sulfide	.94	.77	.65	.66	.75	.81	.70	.70	.74	.70	.60
Oxide											
Bruce											
Sulfide	-	-	2.66	3.45	3.33	3.75	3.92	3.68	3.86	3.73	3.54
Johnson											
Oxide 1/	-	-	-	-	-	-	-	-	-	.42	.42
Old Dick (and Copper Queen)											
Sulfide	3.15	-	-	-	-	-	-	-	-	-	-
Pima											
Sulfide	.73	.58	.58	.54	.54	.54	.53	.51	.50	.48	.47

TABLE III (Continued)

AVERAGE CU CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES  
(Percent Total Copper)

MINE OPERATION	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
EL PASO NATURAL GAS CO.											
Emerald Isle											
Oxide	-								-	-	-
HECLA MINING CO.											
Lakeshore											
Sulfide	-	-	-	-	-	-	-	-	-	-	.76
Oxide 1/	-	-	-	-	-	-	-	-	-	-	1.03
INSPIRATION CONSOLIDATED COPPER CO.											
Christmas (underground)											
Sulfide	1.14	-	-	-	-	-	-	-	-	-	-
Christmas (open pit)											
Sulfide				.77	.63	.65	.80	.74	.57	.57	.58
Inspiration Area Mines											
Sulfide	.47				.73	.69	.71	.67	.63	.65	.63
Oxide	.36										
Ox Hide											
Oxide 1/	-	-			.37	.36	.30			.29	.27
KENNECOTT COPPER											
Ray											
Sulfide					.97	.90	.89	.91	.83	.90	.86
Silicate					1.17	1.39	1.25	1.35	1.19	1.23	1.15
Oxide											

TABLE III (Continued)

AVERAGE CU CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES  
(Percent Total Copper)

MINE OPERATION	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
MCALISTER FUEL CO.											
Zonia											
Oxide			.70			(.53)	(.53)			(.53)	-
NEWMONT MINING CORP.											
Magma											
Sulfide	4.70	4.77	4.63		(4.4)	(4.4)	(4.5)			(4.5)	(4.5)
San Manuel											
Sulfide 2/	.77	.76	.70			(.7)	(.7)		.70	.64	(.7)
PENNZOIL CO. (Duval Corp.)											
Esperanza											
Sulfide	.59	.52	.50	.48	.45	.40	-	.34	.31	.26	.29
Oxide											
Mineral Park											
Sulfide	.51	.52	.51	.52	.50	.50	.41	.38	.36	.30	.28
Oxide											
Sierrita											
Sulfide	-	-			.28	.27	.29	.28	.29	.33	.35
PHELPS DODGE CORP.											
Copper Queen											
Sulfide	4.23	4.18	4.08	4.23	4.36	4.31	4.41	4.06	3.48	5.70	-
Oxide											
Lavender											
Sulfide	.70	.76	.67	.81	.77	.68	.64	.60	.47	-	-
Oxide											
Metcalf											
Sulfide	-	-	-	-	-	-	-	-	-	.84	.86
Oxide	-	-	-	-	-	-	-	-	-		

TABLE III (Continued)

AVERAGE CU CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES  
(Percent Total Copper)

<u>MINE OPERATION</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
PHELPS DODGE CORP. (Continued)											
Morenci											
Sulfide	.86	.86	.84	.86	.85	.85	.83	.82	.82	.79	.80
Oxide											
New Cornelia											
Sulfide	.74	.75	.74	.73	.68	.67	.70	.61	.57	.57	.66
RANCHERS EXPLORATION & DEVELOPMENT CORP.											
Bluebird											
Oxide						.46	.44			.48	.58
Old Reliable											
Oxide	-	-	-	-	-	-	.74	.74	.74	.74	-
STANDARD METALS CORP.											
Antler											
Sulfide	-	-	-	-		-	-	-	-	-	-
WEIGHTED AVERAGE <u>SULFIDE</u> GRADE <u>3/</u>	<u>.80</u>	<u>.75</u>	<u>.72</u>	<u>.73</u>	<u>.73</u>	<u>.64</u>	<u>.64</u>	<u>.60</u>	<u>.57</u>	<u>.56</u>	<u>.61</u>

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

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

1/ Acid soluble copper.

2/ Sulfide copper.

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

TABLE IV  
CONTAINED CU RECOVERIES AT ARIZONA COPPER MINES 1/  
(Percent of Total Copper)

MINE OPERATION		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Twin Buttes	Sulfide	-	-	-		80	72	76	72	71	63	68
	Oxide	-	-	-	-	-	-	-	-	-	65	75
Mineral Hill	Oxide	-	-	-	-	-	-	-	-	-	-	-
Mission	Sulfide	87	88	90	91	86	88	89	88	88	88	89
Sacaton	Sulfide	-	-	-	-	-	-	-	-	78	82	82
San Xavier	Sulfide	-	-	-	-	-	-	-	-	-	-	-
	Oxide	-	-	-	-	-	-	-	49	63	67	77
Silver Bell	Sulfide	72	74	65	74	75	78	85	80	78	77	81
Copper Cities	Sulfide	-	-	-	-	-	-	-	-	-	-	-
Pinto Valley	Sulfide	-	-	-	-	-	-	-	-	-	-	-
Bagdad	Sulfide	69	80	81	76	73	77	88	82	77	81	86
Bruce	Sulfide	-	-	85	85	85	85	90	90	90	93	92
Johnson	Oxide <u>2/</u>	-	-	-	-	-	-	-	-	-	43	91
Old Dick	Sulfide	96	-	-	-	-	-	-	-	-	-	-
Pima	Sulfide	89	86	85	86	84	86	84	85	85	82	84
Emerald Isle	Oxide	-	-	-	-	-	-	-	-	-	-	-
Lakeshore	Sulfide	-	-	-	-	-	-	-	-	-	-	-
	Oxide <u>2/</u>	-	-	-	-	-	-	-	-	-	-	-
Christmas (UG)	Sulfide	-	-	-	-	-	-	-	-	-	-	-
Christmas (OP)	Sulfide				72	75	68	76	66	70	73	77
Inspiration Area	Sulfide <u>3/</u>					39	47	47	45	48	46	45
	Oxide											
Ox Hide	Oxide <u>2/</u>	-	-			47	42	67			76	67
Ray	Sulfide											
	Oxide <u>4/</u>	-	-	-								
Zonia	Oxide											
Magma	Sulfide	97	91	95								
San Manuel	Sulfide <u>5/</u>	92	93	93						90	87	

In-situ Leach 1973-75

TABLE IV (Continued)  
CONTAINED CU RECOVERIES AT ARIZONA COPPER MINES 1/  
(Percent of Total Copper)

MINE OPERATION		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Esperanza	Sulfide	80	81	81	78	83	87	-	87	89	90	91
Mineral Park	Sulfide	82	80	79	82	80	80	77	81	72	81	73
	Oxide											
Sierrita	Sulfide	-	-	-	-	84	91	84	90	89	90	88
Copper Queen	Sulfide	87	89	88	89	87	88	95	90	90	92	-
Lavender	Sulfide	73	73	67	65	70	64	69	67	52	-	-
Metcalf	Sulfide	-	-	-	-	-	-	-	-	-	63	54
	Oxide	-	-	-	-	-	-	-	-	-		
Morenci	Sulfide	77	72	73	76	74	76	75	71	74	70	70
	Oxide											
New Cornelia	Sulfide	88	88	88	87	87	86	84	85	85	80	80
Bluebird	Oxide						45	35			36	45
Antler	Sulfide	-	-	-	-		-	-	-	-	-	-

Source: Company Annual Reports and Form 10-K's; Az. Dept. 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.



TABLE V

STRIPPING RATIOS AT ARIZONA OPEN-PIT COPPER MINES 1/  
(Waste: Ore)

<u>MINE</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Twin Buttes	-	-	-	20.1:1 <sup>2/</sup>	7.3:1	10.2:1	5.3:1	7.6:1	10.8:1	71.6:1	3/ 5.5:1
Mission	4.9:1	3.1:1	2.7:1	2.6:1	2.3:1	3.1:1	3.1:1	2.5:1	2.3:1	1.5:1	1.5:1
Sacaton	-	-	-	-	-	-	-	-	..	6.3:1	5.9:1
San Xavier	-	-	-	-	-	-	-	-	-	-	5.1:1
Silverbell	2.5:1	2.4:1	1.9:1	2.2:1	2.7:1	2.6:1	2.5:1	3.5:1	3.4:1	2:1	1.6:1
Copper Cities	1.9:1	1.9:1	1.7:1	1.8:1	3.1:1	2:1	1.1:1	1:1.3	1.3:1	-	-
Pinto Valley	-	-	-	-	-	-	-	-	-	1.8:1	1.7:1
Bagdad	4.1:1	3.9:1	3.7:1	4:1	4.1:1	4.4:1	5.2:1	5.2:1	4.5:1	1.2:1	9.8:1
Johnson	-	-	-	-	-	-	-	-	-	1:1.8	1.5:1
Pima	-	-	-	-	-	-	-	1.6:1	2.8:1	2:1	2:1
Christmas	1.6:1	3.6:1	5.1:1	4.4:1	5.5:1	4.1:1	4.9:1	5.8:1	5.1:1	3.4:1	3.1:1
Inspiration Area	1.3:1	1.3:1	1:1	1.3:1	1.5:1	1.7:1	1.8:1	1.9:1	2.2:1	3.1:1	1.9:1
Ox Hide	-	-	0	1:11.4	1:4.8	1:391.4	1:2.3	1:35.6	1:3.1	1:2.6	1:2.6
Ray	2:1	1.9:1	2.8:1	2.3:1	2.1:1	1.7:1	2.7:1	2.6:1	3:1	3.5:1	2.6:1
Esperanza	2.3:1	1.8:1	1.4:1	1.7:1	1.5:1	1.4:1	-	1.5:1	1.5:1	1:1.4	1.1:1
Mineral Park	1.7:1	2.2:1	1.8:1	1.8:1	1.4:1	1.4:1	1:1.2	1:1.5	1:1.1	1:1.5	2.1:1
Sierrita	-	-	-	70.7:1 <sup>2/</sup>	3.3:1	1.8:1	1.7:1	1.5:1	1.7:1	1.4:1	1.5:1
Lavender	4.1:1	4.4:1	4.5:1	4:1	2.7:1	1.5:1	1:2.1	1.1:1	1:1.2	-	-
Metcalf	-	-	-	-	-	-	-	-	-	2.8:1	1.8:1

TABLE V (Continued)

STRIPPING RATIOS AT ARIZONA OPEN-PIT COPPER MINES 1/  
(Waste:Ore)

<u>MINE</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Morenci	1.5:1	1.6:1	1.8:1	1.8:1	1.8:1	2.2:1	1.9:1	2:1	1.8:1	1.3:1	1.5:1
New Cornelia	1.4:1	1.6:1	1.9:1	1.6:1	1.5:1	2:1	1.9:1	1.9:1	1.5:1	1.5:1	1.1:1
Bluebird <u>4/</u>	1:4.5	1:4.8	1:3.4		1:1.5	1:1	1:1.2		1:1	1.3:1	1.3:1
<hr/>											
AVERAGE	2.3:1	2.3:1	2.2:1	2.3:1 <u>5/</u>	2.6:1	2.6:1	2.3:1	2.5:1	2.6:1	2:1 <u>6/</u>	2.7:1

Source: "Minerals Yearbook-Area Reports: Domestic", U. S. Bureau of Mines; Company Annual Reports; Az. Dept. 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/ Fiscal year from Jul. 1 to June 30.

5/ Excludes ratios at Twin Buttes and Sierrita.

6/ Excludes ratio at Twin Buttes.

TABLE VI

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

## RECOVERED FROM COPPER ORE

<u>Year</u>	<u>Copper Ore 1/ Tons</u>	<u>Gold 2/ Troy Ounces Value 5/</u>	<u>Silver 2/ Troy Ounces Value 6/</u>	<u>Molybdenum 3/ 1,000 lbs Value (in \$1,000)</u>	<u>Pounds Value</u>	<u>Copper 4/ Lbs./Ore-Ton Ave. 7/</u>	<u>Value of Copper Gold, Silver &amp; Molybdenum</u>
1966	101,558,298	127,431 \$4,460,085	5,595,644 \$7,235,168	10,161 \$17,812	1,359,481,200 \$ 491,724,350	13.39 36.170	\$ 521,231,603
1967	74,289,203	66,933 \$2,342,655	3,996,587 \$6,193,431	9,261 \$15,385	901,853,500 \$ 344,742,519	12.14 38.226	\$ 368,663,605
1968	101,293,963	89,419 \$3,510,600	4,697,394 \$10,074,000	12,127 \$19,207	1,146,313,600 \$ 479,697,900	11.32 41.847	\$ 512,489,500
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

TABLE VI (Continued)

ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD, AND SILVER  
RECOVERED FROM COPPER ORE

<u>Year</u>	<u>Copper Ore 1/ Tons</u>	<u>Gold 2/ Troy Ounces Value 5/</u>	<u>Silver 2/ Troy Ounces Value 6/</u>	<u>Molybdenum 3/ 1,000 lbs Value (in \$1,000)</u>	<u>Copper 4/ Pounds Lbs. Ore-Ton Value Ave. ¢/lb. 7/</u>	<u>Value of Copper Gold, Silver &amp; Molybdenum</u>	
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

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

1/ Includes some copper-zinc 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. 6/ At E/MJ average N. Y. market price for .999 fine silver. 7/ At E/MJ average price, domestic, f.c.b. refinery.

TABLE VII

## MINERAL PRODUCTION IN ARIZONA 1/

Mineral		1975		1976	
		Quantity	Value (thousands)	Quantity	Value (thousands)
Asbestos	short tons	1,676	W	NA	W
Clays 2/	thousand short tons	129	\$483	28	\$361
Coal (bituminous)	do	6,986	W	10,420	W
Copper (recoverable content of ores, etc.)	short tons	813,211	1,044,162	1,024,421	1,425,994
Gem stones		NA	5,000	NA	4,000
Gold (recoverable content of ores, etc.)	troy ounces	85,790	13,854	102,062	12,790
Gypsum	thousand short tons	117	419	139	529
Lead (recoverable content of ores, etc.)	short tons	420	181	338	156
Lime	thousand short tons	512	12,444	546	16,115
Mica, scrap	do	2	65	NA	W
Molybdenum (content of concentrate)	thousand pounds	25,030	61,411	31,073	89,148
Natural gas	million cubic feet	208	58	262	74
Petroleum (crude)	thousand 42-gallon barrels	635	3,332	519	2,724
Pumice	thousand short tons	856	1,294	802	1,240
Sand and gravel 3/	do	17,222	36,490	18,131	40,184
Silver (recoverable content of ores, etc.)	thousand troy ounces	6,286	27,783	7,615	33,126
Stone	thousand short tons	3,404	11,030	4,147	13,921

TABLE VII (Continued)

MINERAL PRODUCTION IN ARIZONA <sup>1/</sup>

Mineral	1975		1976	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Zinc (recoverable content of ores, etc.) short tons	8,655	\$ 6,751	9,501	\$ 7,030
Value of items that cannot be disclosed: Asbestos, Cement, Clays (ball and common), Feldspar, Flourspar, Helium (high purity), Iron ore, Mica (crude) <sup>4/</sup> , Perlite, Pyrite, Salt, Sand and gravel (industrial), Tungsten, and values indicated by symbol W	XX	63,666	XX	79,229
Total	XX	\$1,288,423	XX	\$1,726,621
Total 1967 constant dollars	XX	\$ 509,829	XX	\$ 620,720 <sup>p/</sup>

Source: "The Mineral Industry of Arizona", U. S. Bureau of Mines, Jan. 1978.

W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable. <sup>p/</sup> Preliminary. NA Not available.

- <sup>1/</sup> Production as measured by mine shipments, sales, or marketable production (including consumption by producers).  
<sup>2/</sup> Excludes ball clay and common clay.  
<sup>3/</sup> Excludes industrial sand and gravel.  
<sup>4/</sup> Crude mica includes figures listed previously under both scrap mica and sheet mica, where applicable.



TABLE VIII

## ARIZONA MINE PRODUCTION OF COPPER, LEAD, ZINC, GOLD AND SILVER

1858 To Present - In terms of Recoverable Metals

	COPPER		LEAD		ZINC	
	Short Tons	Value (Thousands)	Short Tons	Value (thousands)	Short Tons	Value (thousands)
1858 - 1974	27,585,417	\$16,306,217	656,251	\$130,673	1,075,450	\$271,274
1975	813,211	1,044,162	420	181	8,655	6,751
1976	1,024,421	1,425,974	338	156	9,501	7,030
Total 1858 - 1976	29,423,049	\$18,776,373	657,009	\$131,010	1,093,606	\$285,055
COMBINED VALUE COPPER, LEAD, ZINC, GOLD AND SILVER						
	GOLD		SILVER			
	Ounces	Value (thousands)	Ounces	Value (thousands)		
1858 - 1974	14,251,601	\$408,365	442,900,226	\$509,500	\$17,626,029,000 r/	
1975	85,790	13,854	6,286,000	27,783	1,092,731,000	
1976	102,062	12,790	7,615,000	33,126	1,479,096,000	
Total 1858-1976	14,439,453	\$435,009	456,801,226	\$570,409	\$20,118,725,000	
Est. Value of other Metals & Non-Metallics produced through 1974				\$1,658,348,000		
Value of Other Metals & Non-Metallics Produced in 1975 a/				195,692,000		
Value of Other Metals & Non-Metallics Produced in 1976 a/				247,525,000		
Total Est. Value of Other Metals & Non-Metallics Produced through 1976					2,101,565,000	
GRAND TOTAL ESTIMATED VALUE OF ARIZONA MINERAL PRODUCTION THROUGH 1976					\$22,220,290,000	

Source: Arizona Bureau of Geology and Mineral Technology; U. S. Geological Survey; "Minerals Yearbook-  
Area Reports: Domestic", U. S. Bureau of Mines  
r/ Revised; a/ For Production detail see Table VII.

TABLE IX

ARIZONA MINE PRODUCTION (RECOVERABLE) OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN 1975, BY CLASS OF ORE OR OTHER SOURCE MATERIAL

Source	Number of Mines <u>1/</u>	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold, gold-silver and silver <u>2/</u>	5	340,261	2,692	62,466	225	2	(3/)
Copper	29	168,655,544	82,385	6,155,669	748,352	223	22
Copper-zinc	1	94,608	374	35,136	3,137	-	8,367
Lead and lead-zinc <u>2/</u>	3	3,130	11	7,106	-	188	267
Total <u>4/</u>	33	168,753,282	82,770	6,197,911	751,489	412	8,655
Other lode material:							
Gold-silver tailings	1	65,216	320	24,286	80	-	-
Copper tailings, silver cleanup and lead cleanup <u>2/</u>	1	558 <u>5/</u>	8	1,191	5,568	7	-
Copper precipitates	14	85,170	-	-	55,848	-	-
Total	15	150,944	328	25,477	61,496	7	-
Grand Total <u>4/</u>	39	169,244,487	85,790	6,285,854	813,211	420	8,655

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

- 1/ Detail will not add to total because some mines produce more than one class of material.  
2/ Combined to avoid disclosing individual company confidential data.  
3/ Less than 1/2 unit.  
4/ Data may not add to total shown because of independent rounding.  
5/ Excludes newly generated tailings.

TABLE X.

ARIZONA MINE PRODUCTION (RECOVERABLE) OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN 1976, BY CLASS OF ORE OR OTHER SOURCE MATERIAL

Source	Number of mines <u>1/</u>	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tcns)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold, gold-silver, and silver <u>2/</u>	10	993,177	3,860	289,065	25	2	-
Copper	27	194,046,281	97,636	7,276,850	953,447	280	36
Copper-zinc	1	90,278	325	31,545	2,768	-	9,349
Lead and lead-zinc <u>2/</u>	3	1,313	18	2,554	1	56	115
Total <u>3/</u>	31	194,137,872	97,979	7,310,949	956,216	336	9,501
Other lode material:							
Gold-silver tailings and copper tailings <u>2/</u>	3	40,985 <u>4/</u>	223	15,098	18,868	-	-
Copper precipitates	11	70,117	-	-	49,313	-	-
Total <u>2/</u>	14	111,102	223	15,098	68,180	-	-
Grand Total <u>3/</u>	45	195,242,151	102,062	7,615,112	1,024,421	338	9,501

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

2/ Combined to avoid disclosing individual company confidential data.

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

4/ Excludes newly generated tailings.

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

TABLE XI  
MAJOR DESIGNED COPPER CAPACITY IN ARIZONA <sup>1/</sup>  
(Short Tons of Recoverable Copper/Year)

<u>OPERATOR</u>	<u>MINE</u>	<u>CAPACITY</u>
Phelps Dodge	Morenci	150,000
Newmont	San Manuel	140,000
Anamax	Twin Buttes	126,000
Kennecott	Ray	95,000
Pennzoil (Duval)	Sierrita	90,000
Cyprus	Pima	80,000
Cyprus	Bagdad	75,000
Hecla	Lakeshore	65,000
Cities Service	Pinto Valley	62,500
Phelps Dodge	Metcalf	60,000
Inspiration	Inspiration Area	55,000
Phelps Dodge	New Cornelia	50,000
ASARCO	Mission	45,000
Newmont	Magma (Superior)	40,000
ASARCO	Silver Bell	25,000
ASARCO	Sacaton	21,000
Pennzoil (Duval)	Mineral Park	20,000
Pennzoil (Duval)	Esperanza	18,000
ASARCO	San Xavier	12,000
Ranchers	Bluebird	8,000
Cities Service	Miami	6,000
Inspiration	Christmas	6,000
Cyprus	Johnson	5,000
Inspiration	Ox Hide	5,000
Phelps Dodge	Copper Queen/Lavender	4,000
Cities Service	Copper Cities	1,500
TOTAL		1,265,000

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

<sup>1/</sup> Figures generally represent a current estimate of the potential productive capacity of primary recoverable copper in concentrates, precipitates, and cathodes. 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.

TABLE XII

## MINE PRODUCTION OF RECOVERABLE COPPER IN THE UNITED STATES

(Short Tons)

<u>STATE</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>RANK IN 1976</u>
Arizona	858,783	813,211	1,024,421	1
California	194	344	375	12
Colorado	3,012	3,560	2,431	10
Idaho	2,841	3,192	3,362	9
Maine	1,522	2,024	1,766	11
Michigan	67,012	73,690	43,707	6
Missouri	12,665	14,258	11,050	8
Montana	131,131	87,959	91,111	4
Nevada	84,101	81,210	58,160	5
New Mexico	196,585	146,263	172,360	3
Pennsylvania	-	-	240	13
Tennessee	6,304	10,041	11,131	7
Utah	230,593	177,155	185,458	2
Washington	-	-	14	14
Other States <u>1/</u>	<u>2,259</u>	<u>459</u>	<u>-</u>	
TOTALS	1,597,002	1,413,366	1,605,586	

Source: "Minerals Yearbook-Metals, Minerals, and Fuels", U. S. Bureau of Mines.

1/ Includes: Oklahoma, Oregon and Washington in 1974;  
Oklahoma, Oregon, Washington, and Wisconsin 1975.

TABLE XIII

## UNITED STATES PRODUCTION AND VALUE OF COPPER, GOLD, AND SILVER

## RECOVERED FROM COPPER ORE

<u>Year</u>	<u>Copper Ore Tons</u>	<u>Gold 1/ Troy Ounces Value 3/</u>	<u>Silver 1/ Troy Ounces Value 4/</u>	<u>Copper 2/ Pounds Value</u>	<u>Lbs./Ore Ton Ave. ¢/lb. 5/</u>	<u>Value of Copper, Gold and Silver</u>
1966	186,966,042	547,327 \$19,156,445	13,230,411 \$17,106,921	2,499,863,100 \$ 904,200,483	13.37 36.170	\$ 940,463,849
1967	127,066,097	321,398 \$11,248,930	8,351,423 \$12,942,033	1,608,078,200 \$ 614,703,973	12.66 38.226 6/	\$ 638,894,936
1968	170,054,065	405,863 \$15,934,200	9,532,341 \$20,443,000	2,055,156,700 \$ 860,021,400	12.09 41.847 7/	\$ 896,398,600
1969	223,751,510	579,297 \$24,440,500	13,581,516 \$24,320,000	2,691,376,400 \$1,279,318,900	12.03 47.534	\$1,328,079,400
1970	257,729,000	552,140 \$21,080,600	15,728,600 \$27,852,500	3,025,021,000 \$1,745,437,000	11.74 57.700	\$1,794,370,000
1971	242,656,000	478,281 \$19,518,648	13,142,041 \$20,312,339	2,677,569,000 \$1,377,073,737	11.03 51.433	\$1,416,904,724
1972	266,831,000	484,552 \$28,297,837	14,655,772 \$24,688,381	2,922,127,000 \$1,479,180,687	10.95 50.617	\$1,532,166,905



TABLE XIII (Continued)

## UNITED STATES PRODUCTION AND VALUE OF COPPER, GOLD, AND SILVER

## RECOVERED FROM COPPER ORE

Year	Copper Ore Tons	Gold <u>1/</u> Troy Ounces Value <u>3/</u>	Silver <u>1/</u> Troy Ounces Value <u>4/</u>	Copper <u>2/</u> Pounds Value	Lbs./Ore Ton Ave. ¢/lb. <u>5/</u>	Value of Copper, Gold and Silver
1973	273,025,000	479,366 \$46,886,788	15,910,462 \$40,691,961	2,902,524,000 \$1,708,425,626	10.63 58.865	\$1,796,004,375
1974	293,443,000	410,866 \$65,626,804	14,106,821 \$66,414,631	2,852,933,000 \$2,186,744,615	9.80 76.649	\$2,318,786,050
1975	263,003,000	325,620 \$52,584,374	12,132,645 \$53,608,335	2,483,524,000 \$1,577,906,973	9.44 63.535	\$1,684,099,682
1976	283,736,000	325,781 \$40,826,875	13,632,135 \$59,346,954	2,914,601,000 \$2,005,944,992	10.27 68.824	\$2,106,118,821

Source: "Minerals Yearbook-Metals, Minerals, and Fuels", U. S. Bureau of Mines.

- 1/ Excludes gold and silver recovered from vat or heap leaching of copper ores and from copper tailings or copper cleanup in 1969 and thereafter. 2/ Excludes precipitate copper from dump and in-place leaching.  
3/ At average domestic free-market gold price in 1968 and thereafter (note 5/ in Table VI). 4/ At E/MJ average N.Y. market price for .999 fine silver. 5/ At E/MJ average price, domestic, f.o.b. refinery.  
6/ Based on first 8 months of 1967. 7/ Based on last 9 months of 1968.

TABLE XIV

## UNITED STATES PRODUCTION AND CONSUMPTION OF COPPER

(Short Tons)

<u>Year</u>	<u>PRODUCTION</u>			<u>CONSUMPTION</u>	Total Production As % of Consumption
	<u>Mine 1/</u>	<u>Secondary 2/</u>	<u>Total</u>	<u>Total 3/</u>	
1950	909,343	260,704	1,170,047	1,424,434	82.2
1951	928,330	186,462	1,114,792	1,416,865	78.7
1952	925,359	173,904	1,099,263	1,479,732	74.3
1953	926,448	242,855	1,169,303	1,494,215	78.3
1954	835,472	212,241	1,047,713	1,254,729	83.5
1955	998,570	246,928	1,245,498	1,502,004	82.9
1956	1,104,156	273,060	1,377,216	1,521,389	90.5
1957	1,086,141	248,015	1,334,156	1,347,815	99.0
1958	979,329	255,121	1,234,450	1,250,677	98.7
1959	824,846	261,588	1,086,434	1,463,031	74.3
1960	1,080,169	300,259	1,380,428	1,349,896	102.3
1961	1,165,155	290,805	1,455,960	1,462,830	99.5
1962	1,228,421	301,374	1,529,795	1,599,676	95.6
1963	1,213,166	314,643	1,527,809	1,744,273	87.6
1964	1,246,780	366,197	1,612,977	1,825,281	88.4

TABLE XIV (Continued)

## UNITED STATES PRODUCTION AND CONSUMPTION OF COPPER

(Short Tons)

<u>Year</u>	<u>PRODUCTION</u>			<u>CONSUMPTION</u>	Total Production As % of Consumption
	<u>Mine 1/</u>	<u>Secondary 2/</u>	<u>Total</u>	<u>Total 3/</u>	
1965	1,351,734	462,811	1,814,545	2,004,623	90.5
1966	1,429,152	509,084	1,938,236	2,359,954	82.1
1967	954,064	423,054	1,377,118	1,935,592	71.1
1968	1,204,621	433,041	1,637,662	1,880,300	87.1
1969	1,544,579	514,593	2,059,172	2,142,218	96.1
1970	1,719,657	521,137	2,240,794	2,043,303	109.7
1971	1,522,183	429,095	1,951,278	2,019,507	96.6
1972	1,664,840	447,409	2,112,249	2,238,867	94.3
1973	1,717,940	484,623	2,202,563	2,437,048	90.3
1974	1,597,002	513,308	2,110,310	2,194,168	96.2
1975	1,413,366	355,512	1,768,878	1,534,508	115.3
1976	1,605,586	390,729	1,996,315	1,991,885	100.2

Source: "Minerals Yearbook-Metals, Minerals, and Fuels", U. S. Bureau of Mines.

1/ Recoverable copper.2/ Copper recovered as unalloyed copper only.3/ Refined copper in cathodes, wire bars, etc.; reported by consumers.

TABLE XV

## IMPORTS OF PRIMARY COPPER INTO THE UNITED STATES BY COUNTRY OF ORIGIN

<u>Source of Import</u>	<u>Copper Content (Short tons)</u>				
	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>Ore, Concentrate, Matte:</u>					
Australia	2,091	1,531	2,379	2,134	465
Botswana	-	-	625	5,489	14,224
Canada	12,118	11,583	20,062	39,033	47,289
Chile	71	1,654	7	37	-
Honduras	-	-	4,595	2,094	-
Mexico	8	1,113	2,069	2,461	4
Nicaragua	95	200	2,771	410	533
Papua New Guinea	-	-	-	-	1,949
Peru	9,486	8,697	7,284	6,077	4,323
Philippines	30,122	19,042	14,244	12,601	15,047
Poland	-	-	-	117	-
Rhodesia	-	-	-	-	1,025
South Africa, Republic of	-	-	1,754	3,153	3,949
United Kingdom	761	23	166	1	-
Other Countries	<u>261</u>	<u>238</u>	<u>89</u>	<u>364</u>	<u>162</u>
Total Ore, etc.	55,013	44,081	56,045	73,971	88,970

TABLE XV (Continued)

## IMPORTS OF PRIMARY COPPER INTO THE UNITED STATES BY COUNTRY OF ORIGIN

<u>Source of Import</u>	<u>Copper Content (Short tons)</u>				
	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>Blister Copper:</u>					
Canada	5,871	1,181	3	4	158
Chile	33,208	29,617	65,093	26,283	30,817
Kenya	1,804	-	3,081	-	-
Mexico	9,544	8,799	7,644	8,822	3,144
Peru	81,559	86,896	94,686	30,951	6,726
South Africa, Republic of	23,053	26,279	37,211	2,470	-
South West Africa	-	-	-	20,414	2,521
Yugoslavia	2,205	937	-	-	-
Zambia	-	-	-	-	1,108
Other Countries	188	395	112	7	10
Total Blister	157,432	154,104	207,830	88,951	44,484
<u>Refined, Cathodes and Shapes:</u>					
Australia	388	498	83	1,273	1,329
Belgium-Luxemburg	-	9,982	8,024	7,405	3,664
Brazil	370	-	-	-	-
Canada	124,983	130,553	118,429	70,747	94,025
Chile	26,598	27,492	66,549	28,626	69,873
France	8	805	664	-	-
Germany, West	1	8,627	7,177	-	-
Italy	-	-	-	-	3,307
Japan	1,125	22	73,055	8,259	-

TABLE XV (Continued)

## IMPORTS OF PRIMARY COPPER INTO THE UNITED STATES BY COUNTRY OF ORIGIN

<u>Source of Import</u>	<u>Copper Content (Short tons)</u>				
	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>Refined, Cathodes and Shapes:(Cont'd)</u>					
Mexico	7,620	2,132	873	912	424
Netherlands	-	2,110	3,253	-	-
Norway	208	306	294	242	-
Peru	2,204	4,384	6,913	6,864	29,034
Poland	-	689	2,192	-	-
South Africa, Republic of	556	81	110	-	992
Tanzania	-	901	-	-	-
U.S.S.R.	-	-	1,102	-	-
United Kingdom	3,938	7,726	6,643	771	3,316
Yugoslavia	24,379	716	14,844	21,494	44,984
Zaire	-	-	-	-	2,582
Zambia	-	5,455	2,825	-	127,162
Other Countries	<u>1</u>	<u>476</u>	<u>539</u>	<u>212</u>	<u>832</u>
Total Refined	192,379	202,955	313,569	146,805	381,524
<hr/>					
Total: Primary Copper Imports	404,824	401,140	577,444	309,727	514,978
Less: Primary Copper Exports	208,924	220,266 r/	141,674 r/	182,278	129,463
(ore, conct.,matte blister & refined)					
Net Primary Imports	<u>195,900</u>	<u>180,874 r/</u>	<u>435,770 r/</u>	<u>127,449</u>	<u>385,515</u>

Source: "Minerals Yearbook-Metals, Minerals, and Fuels", U. S. Bureau of Mines  
r/ Revised

TABLE XVI

## SALIENT COPPER STATISTICS

In short tons

	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>Mine Production</u>			
Arizona	858,783	813,211	1,024,421
United States	1,597,002	1,413,366	1,605,586
World	8,047,959 <u>r/</u>	7,671,661	8,212,779
<u>Primary Refined Stocks at U.S. Refineries a/</u>			
Beginning of Year	37,000	101,000	207,000
End of Year	101,000	207,000	190,000
<u>Primary Refined Prod. of U.S. Refineries</u>			
From Domestic Ores	1,420,905	1,286,189	1,422,723
From Foreign Ores, Matte, etc. <u>a/</u>	233,753	157,189	116,585
Total	<u>1,654,658</u>	<u>1,443,378</u>	<u>1,539,308</u>
<u>Secondary Copper Produced from Scrap</u>			
Recovered as Unalloyed Copper	513,308	355,512	390,729
Recovered in Alloys <u>b/</u>	831,012	616,453	754,545
Total Secondary Copper	<u>1,344,320</u>	<u>971,965</u>	<u>1,145,274</u>
<u>Imports:</u>			
Copper In Ores, Concentrates, Matte	56,045	73,971	88,970
Copper in Blister	207,830	88,951	44,484
Refined Copper <u>a/</u>	313,569	146,805	381,524
Total Imports	<u>577,444</u>	<u>309,727</u>	<u>514,978</u>

TABLE XVI

## SALIENT COPPER STATISTICS (Continued)

	1974	In short tons 1975	1976
<u>Exports:</u>			
Copper in Ores, Concs., Matte, Blister	15,148 r/	9,852	17,576
Refined Copper a/	<u>126,526</u>	<u>172,426</u>	<u>111,887</u>
Total Exports	<u>141,674</u> r/	<u>182,278</u>	<u>129,463</u>
<u>EXCESS OF IMPORTS OVER EXPORTS</u>	<u>435,770</u> r/	<u>127,449</u>	<u>385,515</u>
<u>Consumption:</u>			
Apparent, New Refined (Primary)	1,778,000	1,312,000	1,823,000
Actual, Total Refined	2,194,168	1,534,508	1,991,885
<u>U.S. MINE PRODUCTION VS. U. S. CONSUMPTION</u>			
Production as a Percent of Apparent Consumption	<u>89.8</u>	<u>107.7</u>	<u>88.1</u>
<u>Average Price of Copper c/</u>	<u>76.65¢</u>	<u>63.54¢</u>	<u>68.82¢</u>

Source: "Minerals Yearbook-Metals, Minerals, and Fuels", U. S. Bureau of Mines

r/ Revised

a/ May include some from scrap.

b/ Includes copper in chemicals: 1974-2,649; 1975-2,480; 1976-4,007

c/ At E/MJ average price, domestic, f.o.b. refinery.



TABLE XVII

MINE PRODUCTION OF COPPER IN  
ARIZONA, THE UNITED STATES, AND THE WORLD  
WITH DOMESTIC PRICE OF COPPER

1874 - 1976

Period	ARIZONA			UNITED STATES			WORLD
	Short Tons	% of U. S. Prod.	% of World Prod.	Short Tons	% of World Prod.	Price ¢ Per Pound <sup>a/</sup>	Short Tons
1874							
1911	1,758,000	22.0	9.3	7,989,735 <sup>b/</sup>	49.1	14.40 <sup>c/</sup>	16,260,000
1912	182,519	29.2	16.2	624,547	55.5	16.341	1,125,656
1913	203,962	33.0	18.6	617,755	56.2	15.269	1,099,366
1914 <sup>1/</sup>	196,509	34.2	19.0	574,216	55.5	13.602	1,034,487
1915 <sup>1/</sup>	229,986	30.9	19.6	744,036	63.4	17.275	1,173,150
1916 <sup>1/</sup>	360,917	36.0	23.2	1,002,938	64.6	27.202	1,553,498
1917 <sup>1/</sup>	356,083	37.6	22.2	947,717	59.1	27.180	1,602,914
1918 <sup>1/</sup>	382,428	40.0	24.2	955,011	60.5	24.628	1,579,246
1919	269,050	44.4	24.6	606,167	55.3	18.691	1,095,697
1920	279,128	45.6	26.4	612,275	58.0	17.456	1,056,014
1921 <sup>2/</sup>	92,517	39.7	15.1	233,095	38.0	12.502	613,987
1922	200,022	41.5	21.4	482,292	48.2	13.382	935,374
1923	309,464	41.9	22.8	738,870	54.5	14.421	1,355,327
1924	338,876	42.2	23.0	803,083	54.5	13.024	1,472,712
1925	356,678	42.5	22.6	839,059	53.2	14.042	1,576,998

TABLE XVII (Continued)

Period	ARIZONA			UNITED STATES			WORLD
	Short Tons	% of U. S. Prod.	% of World Prod.	Short Tons	% of World Prod.	Price ¢ Per Pound a/	Short Tons
1926	361,648	41.9	22.7	862,638	54.0	13.795	1,596,147
1927	341,095	41.3	20.5	824,980	49.5	12.920	1,666,694
1928	366,138	40.5	19.2	904,898	47.5	14.570	1,903,672
1929	415,314	41.6	19.3	997,555	46.4	18.107	2,150,587
1930 <u>3/</u>	288,095	40.9	16.2	705,074	39.7	12.982	1,775,805
1931 <u>3/</u>	200,672	37.9	13.0	528,875	34.2	8.116	1,545,425
1932 <u>3/</u>	91,246	38.3	8.0	238,111	20.9	5.555	1,138,676
1933 <u>3/</u>	57,021	29.9	4.9	190,643	16.4	7.025	1,159,000
1934 <u>3/</u>	89,041	37.5	6.3	237,401	16.8	8.428	1,415,353
1935 <u>3/</u>	139,015	36.0	8.4	386,491	23.5	8.649	1,647,939
1936 <u>3/</u>	211,275	34.4	11.1	614,516	32.4	9.474	1,899,263
1937	288,475	34.3	11.2	841,938	32.8	13.167	2,567,916
1938 <u>4/</u>	210,797	37.8	9.3	557,763	24.5	10.000	2,274,145
1939 <u>5/</u>	262,117	36.0	10.6	728,320	29.4	10.965	2,481,277
1940 <u>5/</u>	281,169	32.0	10.5	878,086	32.7	11.296	2,688,510
1941 <u>5/</u>	326,317	34.1	11.2	958,149	33.0	11.797	2,903,458
1942 <u>5/</u>	393,387	36.4	12.9	1,080,061	35.5	11.775	3,039,041
1943 <u>5/</u>	403,181	37.0	13.2	1,090,818	35.6	11.775	3,064,394
1944 <u>5/</u>	358,303	36.8	12.5	972,549	33.9	11.775	2,866,000
1945	287,203	37.2	12.0	772,894	32.2	11.775	2,400,000

TABLE XVII (Continued)

Period	ARIZONA			UNITED STATES			WORLD
	Short Tons	% of U. S. Prod.	% of World Prod.	Short Tons	% of World Prod.	Price ¢ Per Pound a/	Short Tons
1946	289,223	47.5	14.1	608,737	29.6	13.820	2,056,000
1947	366,218	43.2	14.6	847,563	33.9	20.958	2,500,000
1948 <u>6/</u>	375,121	44.9	14.4	834,813	32.1	22.038	2,600,000
1949 <u>6/</u>	359,010	47.7	14.4	752,750	30.1	19.202	2,500,000
1950 <u>7/</u>	403,301	44.4	14.4	909,343	32.5	21.235	2,760,000
1951 <u>7/</u>	415,870	44.8	14.3	928,330	32.0	24.200	2,900,000
1952 <u>7/</u>	395,719	42.8	13.1	925,359	30.6	24.200	3,020,000
1953 <u>7/</u>	393,525	42.5	12.9	926,448	30.4	28.798	3,050,000
1954 <u>8/</u>	377,927	45.2	12.2	835,472	27.0	29.694	3,100,000
1955	454,105	45.5	13.3	998,570	29.2	37.491	3,420,000
1956	505,908	45.7	13.4	1,104,156	29.1	41.818	3,790,000
1957 <u>9/</u>	515,854	47.5	13.3	1,086,859	27.9	29.576	3,890,000
1958 <u>9/</u>	485,839	49.6	12.9	979,329	25.9	25.764	3,780,000
1959 <u>10/</u>	430,297	52.2	10.7	824,846	20.4	31.182	4,040,000
1960	538,605	49.9	11.6	1,080,169	23.2	32.053	4,650,000
1961	587,053	50.4	12.1	1,165,155	24.0	29.921	4,850,000
1962	644,242	52.4	12.7	1,228,421	24.2	30.600	5,085,000
1963	660,977	54.5	13.0	1,213,166	23.8	30.600	5,088,000
1964	690,988	55.4	13.0	1,246,780	23.5	31.960	5,297,000
1965	703,377	52.0	12.7	1,351,734	24.4	35.017	5,549,000

TABLE XVII (Continued)

Period	ARIZONA			UNITED STATES			WORLD
	Short Tons	% of U.S. Prod.	% of World Prod.	Short Tons	% of World Prod.	Price - ¢ Per Pound <u>a/</u>	
1966	739,569	51.7	12.8	1,429,152	24.6	36.170	5,800,000
1967 <u>11/</u>	501,741	52.6	9.0	954,064	17.2	28.226*	5,552,000
1968 <u>11/</u>	627,961	52.1	10.4	1,204,621	20.0	41.847**	6,012,000
1969 <u>12/</u>	801,363	51.9	12.9	1,544,579	24.8	47.534	6,225,000
1970 <u>13/</u>	917,918	53.4	13.8	1,719,657	25.9	57.700	6,638,042
1971 <u>14/</u>	820,171	53.9	12.3	1,522,183	22.9	51.433	6,688,634
1972	908,612	55.2	12.4	1,644,840	22.5	50.617	7,321,950 <u>r/</u>
1973	927,271	54.0	11.8	1,717,940	21.9	58.865	7,844,901 <u>r/</u>
1974 <u>15/</u>	858,783	53.8	10.7 <u>r/</u>	1,597,002	19.8 <u>r/</u>	76.649	8,063,457 <u>r/</u>
1975 <u>15/</u>	813,211	57.5	10.6	1,413,366	18.4	63.535	7,678,948
1976	1,024,421	63.8	12.5	1,605,586	19.5	68.824	8,212,779
Total 1874 -							
1976	<u>29,421,469</u>	<u>43.0</u>	<u>13.0</u>	<u>68,343,917</u>	<u>30.3</u>		<u>225,740,245</u>

Source: Mineral Resources of the U. S., U. S. Geological Survey (Years 1882-1923)  
U. S. Bur. Mines (Years 1923-1931); Minerals Yearbooks and other reports.  
U. S. Bur. Mines (Years 1932-1976); Ariz. Bur. Mines Bull. 140 (1936).

a/ At E/MJ average price, domestic, f.o.b. refinery.

b/ Smelter production from domestic ores prior to and including 1911.

c/ Average price for Arizona copper only prior to and including 1911; calculated from total of values reported or estimated by sources, amounting to \$506,283,000.

TABLE XVII (Continued)

- r/ Revised:  
Based on first 8 months of 1967. \*\*Based on the last 9 months of 1968.
- 1/ World War I 1914-1918.
- 2/ Post World War I Recession (1921). Lasted about one year.
- 3/ Depression began in 1930; was at its worst in 1933; gradually improved to 1937.
- 4/ Recession in 1938. Recovery in 1939 caused by War demand.
- 5/ World War II began in 1939; highest copper consumption in 1944.
- 6/ In 1948 and early 1949, copper was being produced in the U. S. at the rate of 68,000 short tons per month, imports ran 40,000 tons per month of blister and refined copper, exports ran 12,000 tons per month and the price of copper averaged 22.5 cents.  
In March, 1949, Congress suspended the copper import tax, and in the ensuing months domestic demand fell drastically while imports continued at practically the same rate. The price dropped to 16 ½ cents. Many mines were forced to close. Production dropped to 56,000 tons per month from a high of 78,000.
- 7/ Korean War 1950-53.
- 8/ Curtailment early in the year (1954), and a series of strikes in August and September caused a loss in production of over 100,000 tons. Consumption in the U. S. was reduced but the reduction was offset by an appreciable rise in consumption in other countries, chiefly in Europe. Result: a short supply of copper at the end of the year.
- 9/ Recession 1957-58. Import tax restored 7/1/58 after 7-year suspension.
- 10/ First U. S. troops killed in Vietnam in mid-1959. Record copper production rate first half of 1959 but 75% of U. S. output halted in August by strikes which lasted into 1960.
- 11/ A major Copper Strike started in the U. S. on July 16, 1967, and ended in March, 1968. A loss of 855,000 tons of copper production is estimated as a result of the strike.
- 12/ 1969, Highest annual production in U. S. history.
- 13/ 1970, Highest annual production in U. S. history and supply catches up with demand.
- 14/ A copper strike started in the U. S. on July 1, 1971, and ended in August, 1971. A loss of 250,000 tons of copper production is estimated as a result of the strike.
- 15/ Copper strikes lasting maximum of 42 days in 1974; strong inflation coupled with worldwide business recession gave copper industry its worst period since the 1930's.

TABLE XVIII

WORLD MINE PRODUCTION OF COPPER BY COUNTRY 1/  
(Short Tons)

<u>Country</u>	<u>1974</u>	<u>1975</u>	<u>1976 p/</u>
North and Central America:			
Canada <u>2/</u>	<u>r/</u> 905,417	808,094	823,570
Cuba <u>e/</u>	<u>r/</u> 3,200	<u>r/</u> 3,300	3,300
Dominican Republic	<u>e/</u> 500	-	-
Guatemala	<u>1</u> ,994	2,822	3,185
Mexico	91,128	86,196	98,073
Nicaragua <u>3/</u>	1,957	711	696
United States <u>2/</u>	1,597,002	1,413,366	1,605,586
South America:			
Argentina	347	202	<u>e/</u> 220
Bolivia <u>4/</u>	<u>r/</u> 8,962	7,045	<u>5</u> ,277
Brazil	3,390	2,119	<u>e/</u> 2,200
Chile	994,394	913,043	1,108,042
Colombia <u>e/</u>	80	80	80
Ecuador	197	263	<u>e/</u> 300
Peru	233,241	<u>2/</u> 197,340	<u>2/</u> 221,331
Europe:			
Albania <u>e/ 5/</u>	8,540	8,540	8,800
Austria	2,962	2,186	1,254
Bulgaria	55,160	60,583	59,525
Czechoslovakia <u>e/</u>	<u>r/</u> 5,200	<u>r/</u> 5,500	5,500
Finland	39,850	42,770	42,118
France	432	551	<u>e/</u> 550
Germany, East	-	<u>e/</u> 1,700	<u>e/</u> 1,700
Germany, West <u>2/ 6/</u>	1,911	2,162	1,778
Greece	883	1,533	1,080
Hungary <u>e/</u>	1,300	1,300	1,300
Ireland <u>3/</u>	<u>r/</u> 13,942	10,803	4,519
Italy <u>6/</u>	915	1,011	1,010
Norway <u>6/</u>	26,587	30,991	34,728
Poland <u>e/</u>	218,300	<u>r/</u> 260,000	300,000
Portugal <u>6/</u>	6,226	5,577	4,955
Romania <u>5/</u>	<u>e/r/</u> 37,500	<u>e/r/</u> 41,000	44,644
Spain <u>6/7/</u>	37,807	43,344	<u>e/</u> 44,000
Sweden	44,795	44,791	51,987
U.S.S.R/ <u>e/2/5/</u>	816,000	843,000	880,000
United Kingdom	478	504	<u>e/</u> 550
Yugoslavia	123,587	126,649	132,409
Africa:			
Algeria <u>e/</u>	410	440	440
Botswana	2,623	7,154	13,759
Congo (Brazzaville) <u>3/</u>	1,025	1,010	450

TABLE XVIII (Continued)  
WORLD MINE PRODUCTION OF COPPER BY COUNTRY 1/  
(Short Tons)

<u>Country</u>	<u>1974</u>	<u>1975</u>	<u>1976 p/</u>
Africa (Continued):			
Ethiopia e/	440	440	440
Kenya e/	80	80	80
Mauritania	22,133	17,861	10,396
Morocco <u>3/</u>	5,952	5,291	e/4,400
Mozambique <u>3/</u>	689	755	e/770
Rhodesia, Southern <u>8/</u>	43,315	43,531	34,969
South Africa, Republic of	197,436	197,233	217,023
South-West Africa, Territory of <u>3/2/</u>	35,801	e/43,000	e/48,500
Uganda	13,496	9,370	9,921
Zaire	550,524	547,111	490,098
Zambia	769,364	746,177	781,391
Asia:			
Burma <u>10/</u>	77	94	101
China, People's Republic of <u>e/</u>	110,000	110,000	110,000
Cyprus <u>6/</u>	12,346	10,913	11,023
India	30,953	42,990	54,895
Indonesia	71,210	69,997	75,398
Iran <u>11/</u>	1,980	1,980	1,631
Israel	12,100	8,270	-
Japan <u>3/12/</u>	90,538	93,674	89,618
Korea, North <u>e/</u>	14,000	14,000	14,000
Korea, Republic of	3,080	2,944	2,486
Malaysia	e/55	4,189	20,062
Philippines	r/249,077	249,366	255,185
Taiwan <u>e/</u>	2,760	2,100	2,200
Turkey	42,765	40,319	e/35,800
Oceania:			
Australia	277,055	241,363	239,683
Papua New Guinea <u>3/</u>	r/202,491	190,123	193,793
Total	r/8,047,959	7,671,661	8,212,779

Source: "Minerals Yearbook-Metals, Minerals, and Fuels", U. S. Bureau of Mines.

TABLE XVIII (Continued)

WORLD MINE PRODUCTION OF COPPER BY COUNTRY 1/  
(Short Tons)

e/ Estimate

p/ Preliminary

r/ Revised

- 1/ Data presented represents copper content (recoverable where indicated) of ore mined ~~wherever~~ possible. If such data was not available, the nonduplicative total copper content of ores, concentrates, matte, metal and/or other copper-bearing products measured at the least stage of processing for which data was available has been used.
- 2/ Recoverable.
- 3/ Copper content of concentrate produced.
- 4/ Corporation Minera de Bolivia (COMIBOL) production plus exports by medium and small mines.
- 5/ Smelter production.
- 6/ Includes copper content of cupriferous pyrites.
- 7/ Excludes an unreported quantity of copper in iron pyrites which may or may not be recovered.
- 8/ Year ending September 30 of that stated.
- 9/ Data was compiled from operating company reports of Tsumeb Corp. Ltd., General Mining and Finance Corp. Ltd. for Klein Aub Koper Maatskappy Ltd.'s mine near Rehoboth, and Falconbridge Nickel Mines Ltd. for Oamites Mining Company (Pty.) Ltd., Oamites mines. Data for General Mining and Finance Corp. Ltd. are for fiscal years ending June 30 of that stated, while data from other countries are for calendar years.
- 10/ Copper content of matte produced.
- 11/ Year beginning March 21 of that stated.
- 12/ Copper content of run-of-mine production is as follows in short tons: 1974--90,985; 1975--93,952; 1976--90,181.



TABLE XIX

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

Year	Average No. Covered Employees <u>1/</u>	Total Wages	Average Annual Wage	Average Weekly Wage	Tons Copper Ore <u>2/</u>
1947	11,340	\$ 36,365,277	\$ 3,207	\$ 61.67	37,810,448
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

TABLE XIX (Continued)

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

Year	Average No. Covered Employees <u>1/</u>	Total Wages	Average Annual Wage	Average Weekly Wage	Tons Copper Ore <u>2/</u>
1965	15,239	\$ 122,163,124	\$ 8,016	\$154.16	92,859,535
1966 <u>1/</u>	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 <u>2/</u>
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

Source: This report, Table XX; "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 No. of Covered Employees" in this table generally includes practically all workers in copper mining and processing (see Table XX), the number of employees is greater than that number tabulated under "All Employees" in Table XXI. 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 XX.

2/ Mine production in short tons from "Lode ore: Copper" reported by the U. S. Bureau of Mines. In 1972 and thereafter the tonnage may include copper-zinc and lead-zinc ore combined to avoid disclosing individual company confidential data.

TABLE XX

## ARIZONA INDUSTRIES COVERED BY SOCIAL SECURITY

AVERAGE NUMBER OF COVERED EMPLOYEES, TOTAL WAGES, AVERAGE ANNUAL WAGE

AND AVERAGE WEEKLY WAGE

<u>Industry</u>	<u>Average No. of Employees <sup>1/</sup></u>	<u>Total Wages</u>	<u>Average Annual Wage</u>	<u>Average Weekly Wage</u>
<u>YEAR 1974</u>				
Copper Mining <sup>2/</sup>	25,022	\$ 304,910,987	\$12,186	\$234.34
Copper Smelting, Refining & Rod Fabrication <sup>3/</sup>	<u>2,872</u>	<u>35,921,109</u>	<u>12,507</u>	<u>240.53</u>
Total Copper Mng. & Processing	27,894	\$ 340,832,096	\$12,219	\$234.98
Other Mng., Quarry'g & Processing	<u>2,186</u>	<u>28,417,674</u>	<u>13,000</u>	<u>250.00</u>
All Mng., Quarry'g & Processing	30,080	\$ 369,249,770	\$12,276	\$236.07
Mfg., Ex. Copper Processing	109,376	1,140,261,044	10,425	200.48
Construction	57,242	731,039,190	12,771	245.60
Transp., Utilities, etc. <sup>4/</sup>	35,843	407,689,297	11,374	218.74
Wholesale-Retail Trade	175,192	1,198,454,445	6,841	131.55
Services, Finance and Misc.	168,053	1,289,728,390	7,675	147.59
Agriculture & Related Services	3,528	25,546,524	7,241	139.25
State & Local Government	<u>41,932</u>	<u>342,323,902</u>	<u>8,164</u>	<u>157.00</u>
TOTALS AND AVERAGES	621,246	\$5,504,292,562	\$ 8,860	\$170.39

TABLE XX

## ARIZONA INDUSTRIES COVERED BY SOCIAL SECURITY (Continued)

<u>Industry</u>	Average No. of Employees <u>1/</u>	Total Wages	Average Annual Wage	Average Weekly Wage
<u>YEAR 1975</u>				
Copper Mining	22,884	\$ 322,316,026	\$14,085	\$270.87
Copper Smelting, Refining & Rod Fab.	3,066	41,033,152	13,383	257.37
Total Copper Mng. & Processing	25,950	\$ 363,349,178	\$14,002	\$269.27
Other Mng., Quarry'g & Processing	2,161	30,756,582	14,233	273.71
All Mng., Quarry'g & Processing	28,111	\$ 394,105,760	\$14,020	\$269.62
Mfg., Ex. Copper Processing	95,995	1,108,798,254	11,551	222.13
Construction	43,792	585,315,551	13,366	257.04
Transp., Utilities, etc. <u>4/</u>	35,040	437,807,314	12,495	240.29
Wholesale - Retail Trade	174,177	1,251,845,153	7,187	138.21
Services, Finance and Misc.	170,270	1,401,445,541	8,231	158.29
Agriculture & Related Services	3,553	26,631,463	7,495	144.13
State and Local Government	42,903	364,876,641	8,505	163.56
TOTALS AND AVERAGES	593,841	\$5,570,825,677	\$9,381	\$180.40

TABLE XX (Continued)

<u>Industry</u>	<u>Average No. of Employees</u> 1/	<u>Total Wages</u>	<u>Average Annual Wage</u>	<u>Average Weekly Wage</u>
<u>YEAR 1976</u>				
Copper Mining	22,381	\$ 352,299,634	\$15,741	\$302.71
Copper Smelting, Refining and Rod Fabrication	3,250	52,989,400	16,304	313.54
Total Copper Mng. & Processing	25,631	\$ 405,289,034	\$15,812	\$304.08
Other Mng., Quarry'g & Processing	2,291	37,537,967	16,385	315.10
All Mng., Quarry'g & Processing	27,922	\$ 442,827,001	\$15,859	\$304.98
Mfg., Ex. Copper Processing	100,860	1,226,228,098	12,158	233.81
Construction	41,744	562,180,983	13,467	258.98
Transp. Utilities, etc..4/	36,035	499,131,900	13,851	266.37
Wholesale - Retail Trade	184,014	1,409,551,301	7,660	147.31
Services, Finance and Misc.	180,814	1,555,911,623	8,605	165.48
Agriculture & Related Services	3,715	29,616,436	7,972	153.31
State & Local Government	46,362	409,075,808	8,824	169.69
TOTALS AND AVERAGES	621,466	\$6,134,523,150	\$ 9,871	\$189.83

Source: Research & Statistics Unit, Unemployment Insurance Bureau, Arizona Dept. of Economic Security.

- 1/ Includes all covered employees. Figures relating to copper mining and smelting, and manufacturing, are adjusted as described in the following footnotes.
- 2/ In 1974, the employee figure includes all covered workers in copper mining and milling and probably those in one smelter. In 1975 and thereafter, this figure excludes copper smelting & refining and copper rod fabrication.
- 3/ In 1974, the employee figure includes all covered workers in smelting (and other end processing) except probably one smelter (see note 2/).
- 4/ Transportation exclusive of railroads.

TABLE XXI

## EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

## IN THE UNITED STATES AND ARIZONA 1/

All employees				Production Workers											
Period	Ave. No. (Thousands)		Ave. No. (Thousands)		Ave. Weekly Earnings		Ave. Weekly Hours		Ave. Hourly Earnings		Ave. Earnings per Man per Year		Aggregate Man-hours (Thousands)		
	2/	3/	4/	5/	6/		7/		8/						
	Ariz.	U. S.	Ariz.	U.S.	Ariz.	U.S.	Ariz.	U. S.	Ariz.	U. S.	Ariz.	U.S.	Ariz.	U. S.	
1966	15.2	31.9	12.4	26.2	\$150.06	\$140.07	45.2	43.5	\$3.32	\$3.22	\$ 7,803	\$7,284	29,145	59,264	
1967	12.2	25.4	9.0	19.1	141.43	140.18	42.6	43.0	3.32	3.26	7,354	7,284	19,937	42,708	
7 Mos.	15.7	33.2	12.4	27.3	149.41	142.76	44.6	43.5	3.35	3.28					
5 Mos.	7.3	14.4	3.8	7.5	130.05	127.95	39.9	40.4	3.27	3.16					
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	

TABLE XXI (Continued)  
EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING  
IN THE UNITED STATES AND ARIZONA 1/

Period	Copper Ore Shipped or Treated (Thousand Short Tons)		Copper in Copper Ore (Recoverable Content) (Thousand Pounds)		Worker Productivity			
	<u>9/</u>		<u>10/</u>		Copper Ore Mined per Man-hour (Tons)		Recoverable Copper Mined per Man-hour (Pounds)	
	Ariz.	U. S.	Ariz.	U. S.	Ariz.	U. S.	Ariz.	U. S.
1966	101,558	186,966	1,474,447	2,805,136	3.485	3.155	50.590	47.333
1967	74,289	127,066	1,000,572	1,866,087	3.726	2.975	50.187	43.694
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

Source: Research & Analysis Section, Labor Market Information Group, Bureau of Employment and Training, Arizona Dept. of Economic Security; "Employment and Earnings", U. S. Dept. of Labor; "Minerals Yearbook - Metals, Minerals, and Fuels", U. S. Bureau of Mines.

TABLE XXI (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 XX for comparison).
- 2/ These figures are estimates made by the Az. Dept. 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. Bur. 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 Az. Dept. 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 figure for a particular year is the product of "Ave. Hourly Earnings" and "Av. 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/ "Ave. Weekly Earnings" times 52 weeks.
- 8/ Number of production workers times "Ave. Weekly Hours" times 52 weeks.
- 9/ Copper ore mined and shipped or treated by concentration, ~~smelting~~ or leaching.
- 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 Dept. 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.



TABLE XXII  
PROVEN COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
ANAMAX MINING CO.	Twin Buttes	Sulfide	329	0.67	With 0.03% Mo; cutoff @ 0.2% Cu
	"	"	300	0.80	Pub. 1973; "outside current mine plans"; cutoff @ 0.4% Cu
	"	Oxide	57	1.10	Cutoff @ 0.6 Cu
	"	"	28	0.49	Pub. 1973; cutoff @ 0.4% Cu
	Helvetia	Sulfide	320	0.64	Pub. 1973; cutoff @ 0.3% Cu
	"	Oxide	20	0.55	Pub. 1973; acid soluble Cu; cutoff @ 0.3% acid soluble Cu
	Peach Elgin	Mixed	23	0.75	Pub. 1973; cutoff @ 0.4% Cu
ASARCO INC.	Mission	Sulfide	104.455	0.73	Excludes contribution of 31.5M tons to Eisenhower Mining Co.
	Sacaton (OP)	"	21.140	0.70	
	Sacaton East (UG)	"	14.898	1.25	
	San Xavier	"	166.902	0.52	
	"	Oxide	1.050	1.48	
	Silver Bell	Sulfide	26.059	0.66	
	"	Oxide			
AZTEC MINING CORP.	Aztec	Oxide	2	1.00	Unpublished est.
BS & K MINING CO.	Atlas	Mixed			
CASA GRANDE COPPER CO.	Casa Grande	Mixed	350	1.00	

TABLE XXII (Continued)  
PROVEN COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
CITIES SERVICE CO.	Cactus	Oxide	20	0.70	Unpublished est.
	Copper Cities	"		0.50	Pub. 1976
	Miami	"			
	Miami East	Mixed (?)	55	1.95	Pub. 1973
	Old Dominion	Sulfide			
	Pinto Valley	"	350	0.44	Pub. 1972 "recoverable Cu"
	Red Hill	Mixed			
CRANE CO.	Dragoon	Mixed			
CONTINENTAL OIL CO.	Poston Butte	Mixed	500	0.50	Pub. 1972
CYPRUS MINES CORP.	Bagdad	Sulfide	290	0.49	
	"	Oxide	21	0.35	Acid soluble Cu
	"	"	95	0.22	Stockpile; acid soluble Cu after prior leaching
	Bruce	Sulfide	0.1276	3.73	Pub. 1976; with 12.8%
	I-10	Mixed	100	0.52	Unpublished est.; with 0.02% Mo
	Johnson	Oxide	9.9	0.50	Acid soluble Cu
	Johnson	Mixed	10	0.60	Pub. 1974
CYPRUS PIMA MINING CO.	Pima	Sulfide	146	0.48	
EL PASO CO.	Emerald Isle	Oxide	1.5	0.40	Pub. 1977; 3Mt @0.1% Cu
EISENHOWER MINING CO.	Palo Verde (Anamax)	Sulfide	125	0.61	
	Palo Verde (ASARCO)	Sulfide	31.5	0.70	
FREEPORT MINERALS CO.	Santa Cruz	Sulfide			

TABLE XXII (Continued)  
PROVEN COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
HECLA MINING CO.	Lakeshore	Sulfide (dissm)	241	0.70	Pub. 1969
	"	" (tactite)	23.6	1.69	"
	"	Oxide	207	0.71	"
INSPIRATION CONSOLIDATED COPPER CO.	Christmas	Sulfide	33.413	0.905	Pub. 1977; "recoverable Cu"
	"	Oxide			
	Inspiration Area Mines	Mixed	180.136	0.481	" "
	Ox Hide	Oxide	31.328	0.147	" "
	Sanchez	"	79.362	0.180	" "
KENNECOTT COPPER CORP.	Chilito	Sulfide			
	Ray	Mixed	650	0.80	Reported 1977
	Safford	"	2,000	0.41	"
	Safford Ext.	"			
KERR-MCGEE CORP.	Red Mountain	Sulfide		0.71	Pub. 1970; 100Mt. possible
KEYSTONE MINERALS INC.	Korn Kob	Oxide	8	0.50	Pub. 1973
MCALISTER FUEL CO.	Zonia	Oxide	1	0.53	Unpublished est.
MULTIPLE OWNERS	Bisbee-North	Mixed (?)	20	0.80	"
NEWMONT MINING CORP.	Copper Creek	Sulfide			
	Kalamazoo	"			
	Magma	"	9.8	4.80	Reported 1978
	San Manuel	"	474	0.67	
	"	Mixed	130	0.70	Pub. 1969
	Vekol Hills	Sulfide	105	0.56	Pub. 1978; minable by open pit; with 0.014% Mo; 16Mt oxide Cu

TABLE XXII (Continued)  
PROVEN COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
NAVAHO TRIBE (?)	White Mesa	Oxide	2	0.75	Pub. 1955
OCCIDENTAL PETROLEUM CO.	Van Dyke	Oxide	100	0.50	Pub. 1977
ORACLE RIDGE MINING PARTNERS	Oracle Ridge	Mixed (?)	11	2.25	Reported 1977; with 0.5oz Ag/ton(pub.1975)
PENNZOIL CO. (Duval Corp.)	Esperanza	Sulfide	21.850	0.42	With 0.022% Mo
	"	Oxide			
	Mineral Park	Sulfide	49.541	0.30	With 0.036% Mo
	"	Oxide			
	Sierrita	Sulfide	459.842	0.32	With 0.033% Mo
PHELPS DODGE CORP.	Copper Basin	Sulfide	175	0.55	Pub. 1973: minable by open pit; with 0.02% Mo
	Copper Queen	Mixed			
	Dos Pobres	Sulfide	400	0.72	Pub. 1977
	Lavender	"			
	Metcalf	"	415.970	0.77	Pub.1975
	Morenci	"	662.462	0.80	"
	New Cornelia	"	126.623	0.63	"
	United Verde	"			
	"	Oxide			
PRODUCERS MINERALS CORP.	San Juan	Oxide	20	0.50	Unpublished est.
RANCHERS EXPLORATION & DEVELOPMENT CO.	Bluebird	Oxide	75	0.52	Pub. 1971
	Old Reliable	"	4	0.74	"

TABLE XXII (Continued)  
PROVEN COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
V. B. SMITH ESTATE	Dynamite	Sulfide			
STANDARD METALS CORP.	Antler	Sulfide	5.1		With Zn values
STRONG & HARRIS	Strong & Harris	Mixed	60	0.60	Unpublished est.; with 0.70% Zn
					Unpublished est.
SUPERIOR OIL	Pine Flats	Sulfide	12	0.50	
UNDETERMINED	Mineral Hill	Mixed			
UNION OIL	Turquoise	Oxide	10	0.50	Pub. 1970
UNITED STATES GOVERNMENT	Park Hill	Mixed (?)	30	0.45	Unpublished est.
UNITED STATES GOVERNMENT AND U. S. METALS CORP.	Apex	Mixed (?)			

Source: Company Annual Reports, Form 10-K's, and Prospectus; Professional Publications.

1/ Reserves are given with a grade of average total copper content as of December 31, 1977, 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.

\* COPPER RESERVES OF ARIZONA

ANAMAX MINING CO.

1. Twin Buttes
2. Helvetia
3. Peach Elgin

ASARCO INC.

4. Mission
5. Sacaton
6. Sacaton East
7. San Xavier
8. Silver Bell

AZTEC MINING CO.

9. Aztec (Mame)

BS & K MINING CO.

10. Atlas

CASA GRANDE COPPER CO.

11. Casa Grande

CITIES SERVICE CO.

12. Cactus
13. Copper Cities
14. Miami
15. Miami East
16. Old Dominion
17. Pinto Valley
18. Red Hill

CRANE CO.

19. Dagoon

CONTINENTAL OIL CO.

20. Poston Butte

CYPRUS MINES CORP.

21. Bagdad
22. Bruce
23. I-10
24. Johnson

CYPRUS PIMA MINING CO.

25. Pima

EL PASO CO.

26. Emerald Isle

EISENHOWER MINING CO.

27. Palo Verde

FREEMPORT MINERALS CO.

28. Santa Cruz

HECLA MINING CO.

29. Lakeshore

INSPIRATION CONSOLIDATED  
COPPER CO.

30. Christmas
31. Inspiration Area  
Mines
32. Ox Hide
33. Sanchez

KENNECOTT COPPER CORP.

34. Chilito
35. Ray
36. Safford
37. Safford Extension

KERR-MCGEE CORP.

38. Red Mountain

KEYSTONE MINERALS INC.

39. Korn Kob

McALISTER FUEL CO.

40. Zonia

MULTIPLE OWNERS

41. Bisbee North

NEWMONT MINING CORP.

42. Copper Creek
43. Kalamazoo
44. Magma (Superior)
45. San Manuel
46. Vekol Hills

NAVAJO TRIBE (?)

47. White Mesa

OCCIDENTAL PETROLEUM CO.

48. Van Dyke

ORACLE RIDGE MINING  
PARTNERS

49. Oracle Ridge

PENNZOIL CO.  
(DUVAL CORP.)

50. Esperanza
51. Mineral Park
52. Sierrita

PHELPS DODGE CORP.

53. Copper Basin
54. Copper Queen
55. Dos Pobres
56. Lavender
57. Metcalf
58. Morenci

PHELPS DODGE cont.

59. New Cornelia
60. United Verde

PRODUCERS MINERALS CORP.

61. San Juan

RANCHERS EXPLORATION &  
DEVELOPMENT CO.

62. Bluebird
63. Old Reliable

V. B. SMITH ESTATE

64. Dynamite

STANDARD METALS CORP.

65. Antler

STRONG & HARRIS

66. Strong & Harris

SUPERIOR OIL

67. Pine Flats

UNDETERMINED

68. Mineral Hill

UNION OIL

69. Turquoise

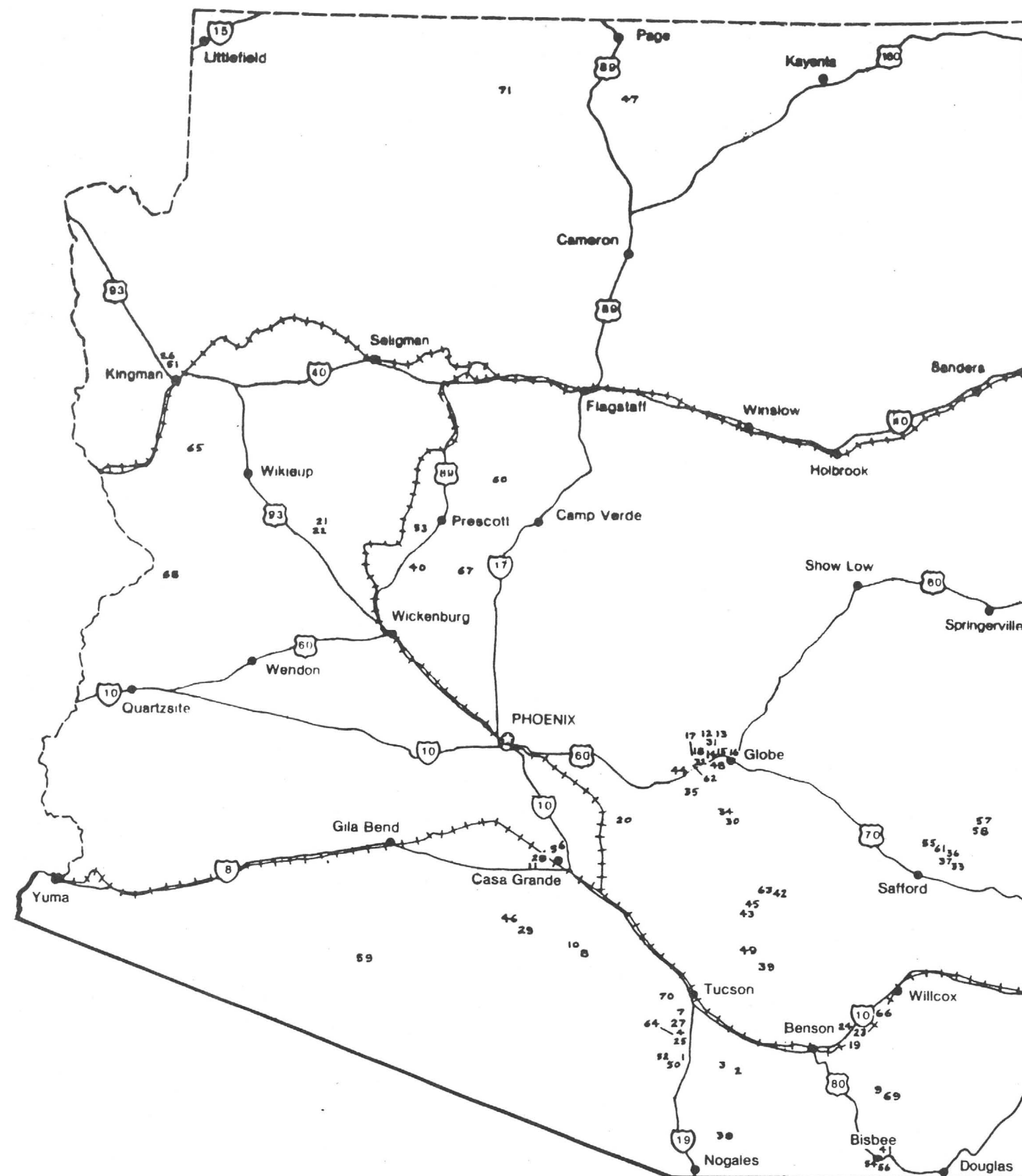
UNITED STATES  
GOVERNMENT

70. Park Hill

UNITED STATES  
GOVERNMENT & U. S.  
METALS CORP.

71. Apex

\*Ownership data is based on best source available to the Department and is subject to revision or change.



## 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.
- Analyse 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.