

**T H E  
C O P P E R  
I N D U S T R Y**

**STATISTICS FOR 1973 COMPARED WITH OTHER YEARS  
ARIZONA, THE UNITED STATES AND THE WORLD**

**COMPILED BY THE ARIZONA DEPARTMENT OF MINERAL RESOURCES**

**FAIRGROUNDS**

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## C O N T E N T S

|                                                                                                                         |            | <u>Page</u> |
|-------------------------------------------------------------------------------------------------------------------------|------------|-------------|
| Copper in 1973                                                                                                          |            | 1-23        |
| <u>Statistics</u>                                                                                                       |            |             |
| Copper and Molybdenum Production of Large Arizona Copper Mines                                                          | Table I    | 24,25       |
| Arizona Leach Copper Production                                                                                         | Table II   | 26          |
| Arizona Copper Mining-Output of Copper Ore; Amount and Value of Copper, Gold, Silver and Molybdenum Recovered Therefrom | Table III  | 27          |
| Arizona Mine Production of Copper, Lead, Zinc, Gold and Silver                                                          | Table IV   | 28          |
| Mine Production of Gold, Silver, Copper, Lead and Zinc in Arizona                                                       | Table V    | 29          |
| Mine Production in Arizona                                                                                              | Table VI   | 30          |
| Arizona Industries Covered by Social Security                                                                           | Table VII  | 31,32       |
| "Covered Employment" and Wages in Arizona Copper Mining and Smelting                                                    | Table VIII | 33          |
| Salient Copper Statistics                                                                                               | Table IX   | 34          |
| Mine Production of Recoverable Copper in the U.S.                                                                       | Table X    | 35          |
| World Mine Production of Copper by Countries                                                                            | Table XI   | 36,37       |
| Mine Production of Copper in Arizona, the U.S. and the World                                                            | Table XII  | 38-40       |
| U.S. Production and Consumption of Copper                                                                               | Table XIII | 41          |
| Imports of Primary Copper into the U.S.                                                                                 | Table XIV  | 42          |
| U.S. Copper Mining-Output of Copper Ore; Amount and Value of Copper, Gold and Silver Recovered Therefrom                | Table XV   | 43          |
| Employment, Earnings and Hours in Copper Mining in the U.S. and Arizona                                                 | Table XVI  | 44-46       |

## COPPER in 1973

Copper, the "Red Metal", ranks second only to iron as the most important metal to civilized mankind. The name comes from the Latin word, cuprum, named after the island of Cyprus; the location of the world's first important copper mines. The chemical symbol for copper is Cu after "cuprum." Copper has atomic number 29; atomic weight 63.54; a melting point of 1083 degrees centigrade; a boiling point of 2336 degrees centigrade; a specific gravity of 8.93 to 8.95 and a chemical valence of 1 or 2.

The discovery of copper dates from prehistoric times. The earliest appearance of worked metal was at Catal Hüyük in Turkey. The little hammered copper tubes found at that locality were apparently used for adornment and have been dated between 6000 and 5500 B.C. Copper is a metallic element, reddish colored, bright, exhibits a metallic luster, is malleable, ductile, a good conductor of heat and electricity. Copper occurs as a native element and in many minerals; the most important of which are the sulfides, oxides and carbonates. From these minerals the metal is recovered by smelting, leaching and/or electrolysis. Copper is used as the pure metal, alloys and in a variety of chemical compounds. Uses vary from copper wire and pipe for building construction and alloys (bronze, brass and coin alloys) to chemicals for agriculture and pharmaceuticals.

Two of copper's properties, its electrical conductivity and ductility, account for its wide use as an electrical conductor in the form of wire. Silver is the only metal whose electrical conductivity is superior to that of copper. In all but the most sophisticated applications, the added cost of silver, with its only slightly better conductivity, is not justified. The manufacture of copper wire accounted for nearly 69% of the copper consumed in the United States in 1973.

The manufacture of brass and related alloys accounted for 29 percent of the copper consumed in 1973. Brass and related alloys are used in the manufacture of castings such as household plumbing fixtures, specialty gears and bushings, stampings such as gaskets and pipe. Copper is alloyed with nearly every other metal to enhance such properties as heat conductivity, strength, corrosion resistance and machinability.

The primary copper industry includes the mining, milling (concentration), smelting (or other recovery methods) and refining of newly mined copper and produces a variety of shapes and forms of copper and copper-bearing materials. A shape known as a wirebar accounted for about 56 percent of the copper marketed to U.S. consumers. Copper in cathodes, the product of electrolytic refining of copper, account for 22 percent of the copper marketed to consumers and are sold to both wire and brass mills. Most copper is refined by electrolysis into cathodes, however, a large percentage of these cathodes are cast into wirebars before leaving the refinery. A wirebar is a specialty shape designed for fabricating into rod and subsequently wire. They are about 3½x5 inches in cross section, up to 54 inches in length, weigh from 175 to 420 pounds, have both ends tapered, and are generally marketed to wire mills. Both wirebar and cathode copper prices are quoted by the major commodity exchanges. Although much of Arizona's copper production is refined and cast into wirebars, this process does not take place in Arizona. A considerable amount of Arizona copper is, however,



produced and sold as cathodes in the State. Two plants in Arizona, one operated by Inspiration Consolidated Copper Company and the other by Magma Copper Company bypass the wirebar step and produce copper rod directly from refined copper. A considerable amount of this Arizona produced wire rod is sold to the Western Electric communication cable plant in Phoenix for manufacture into telephone cable. The final product of most of Arizona smelters is copper anodes which in most cases are shipped out of state for electrolytic refining.

Most of Arizona's copper mining operations produce only copper ore concentrate; a product which contains between 15 and 30 percent copper in mineral compounds with other elements. The concentrate is produced by a variety of complex mechanical and fluid separations, which do not change the chemical composition of the copper minerals. The process involved, termed concentration, separates the copper-bearing mineral particles from the noncopper minerals in the ore. The concentrate is then shipped or sold to a smelter for recovery of the copper. Seven copper smelters operate in Arizona. Those companies operating their own smelters are known as fully integrated producers, many of whom also smelt ore and concentrates for non-integrated mining operations.

The majority of copper produced in the United States is sold at a price that is commonly referred to as the domestic producer quotation. This price is for copper of specified purity in specific shapes, generally cathodes or wirebars, each of which carries its own price. A third price in the producer system is termed "U.S. Producer Refinery" and is the base price from which many custom smelters calculate the price they will pay the small independent miner for his copper ore. Producer prices differ from free market values in that they do not change frequently. Rather, a new price is established whenever supply/demand relationships change significantly. London Metals Exchange (LME) and New York Commodity Exchange prices apparently are key yardsticks for determining change in the market environment. Thus, when these values post sizable gains or losses, domestic producer prices are often increased or decreased. All Arizona produced copper is marketed at prices based on producer quotations.

Nineteen seventy-three was an incredible year for copper prices. Louis Perlman, director of the Commodities Research Unit Limited, writing for the March, 1974, Annual Review issue of Engineering and Mining Journal summarized copper pricing in 1973 with this poetic excerpt from the NASMI Metals Report:

"Listen, my friend, and you shall hear  
Of an unbelievable, impossible year;  
It was the year of '73  
When copper hit jackpot on LME.  
Somewhere indeed the grass was green  
When wirebars sold at a dollar sixteen."

At the beginning of 1973, there was not a hint of the storm of events that were to unfold during the course of the year. As the year began, the price of wirebars on the LME were 48¢ a pound and the producer price was 50.5¢ a pound. In the second week of January, the U.S. producer price for copper was raised by 2.5¢ to 53¢ a pound. Also in January, China entered the copper market on a large scale, thus adding additional demand.

By early February, LME copper was at 54¢ a pound, then the highest level since April, 1971. Encouraged by a massive strike at Europe's largest copper refinery, Olen in Belgium, very large decreases in LME stocks, a further increase in the U.S. producer prices (to 56¢ a pound for wirebars) and the sudden panic in international financial markets, LME copper prices kept increasing to 60¢ a pound at the end of February.

On March 1, the U.S. producer price was raised to 60¢ matching historic highs. LME copper continued its upward trend to reach 71¢ a pound in the middle of March. Prices continued to climb in April along with corresponding drops of stocks in warehouses and large scale labor disruptions occurred at the mines in Chile further decreasing copper availability. Since price controls in the U.S. held the producer copper price fixed at 60¢, the brunt of world developments were felt on the LME.

With the domestic sales price fixed at 60¢, and no price ceiling on export sales, the scrap not committed to domestic buyers under contract started moving out of the country attracted by the higher prices abroad. The end of May and the beginning of June saw a rash of large-scale force majeure in Zambia, Chile and Canada (all major copper producing and exporting nations). LME wirebar prices increased to 80¢ a pound. In the U.S., the announcement of a price freeze quickly caused major disruptions in the supply of copper scrap, which accounts for a significant part (nearly 20%) of the available supply of copper and unlike U.S. producer copper, is not committed to consumers.

Instead of a usual summer lull, the copper market continued its imbalance as the worldwide copper shortage intensified. In the second week of July, the LME copper price hit a new record of nearly \$1.00 a pound. Shortly thereafter, a new rash of partial force majeure were announced by Yugoslavia, by secondary refining facilities in the U.S. (due to the very limited availability of scrap as described earlier), and by many of the major producers in Canada (primarily due to the rail strike).

As the summer ended, copper markets remained turbulent, with prices hovering around 90¢ a pound. At the beginning of September, the unstable political situation in Chile cumulated in a military coup d'etat. This news, along with strikes at the Southern Peru Copper Corporation's mines, further encouraged the general insecurity in world copper markets. The U.S. Senate's ratification of a copper stockpile release bill had only a moments cooling effect on the rapidly climbing free market prices. As the year end approached, major war broke out in the Middle East and several North American copper producers, still experiencing technical difficulties, continued to produce below capacity further pushing copper prices upward.

Copper prices exceeded \$1.00 a pound for wirebars on the LME during the week of November 16 and continued to climb reaching nearly \$1.20 a pound in early December. Price escalation was encouraged by massive speculation, further technical problems and the possible effects of fuel shortages due to Arab embargoes. As 1973 came to an end, U.S. copper producers were allowed to increase their prices to 68.5¢ a pound, additional force majeure were declared, a release of copper from the U.S. defense stockpile won final legal approval and the free market copper price settled to about 95¢ a pound.

Stockpiles of copper, whether they are in the commodity exchanges' warehouses, the U.S. Government Defense Stockpile or consumers' supply inventory, play a significant role in the establishment of prices. A large quantity of copper in the commodity exchanges' warehouses indicate a general easiness of supply and a lack of push toward higher prices. The opposite is true of consumers' inventories. A fabricator (consumer) will hold a large inventory of raw materials which represents a great quantity of tied up capital only if he believes the price of that raw material will rise significantly or if it will be in short supply. If production of copper appears to be sufficient to satisfy demand, the consumer will allow the copper producers and exchanges to hold the copper by not purchasing more than enough to meet immediate demands. Thus when producers are holding large stocks there is a tendency for prices to remain stable or drop.

Under the General Services Administration the U.S. Government maintains a large stockpile of various commodities so as to supply the Nation with an ample supply of these commodities in the event of a national emergency. Although the purpose of the stockpile is to maintain an emergency supply, Congress can, by declaring excesses in the stockpile which may then be sold, effectively reduce commodities prices. Conversely, by building up stockpile levels, the Government becomes an additional buyer and bolsters demand prices and subsequently production. So large is the quantity of most commodities in the stockpile that mere suggestion of stockpile sales exert a downward pressure on prices. Near the end of 1973, Congress and the President had authorized the release of slightly over 250,000 tons of copper from the stockpile. However, nearly half of this was consigned to the Treasury Mint and for military use.

At year end 1973 stock of refined copper at smelters, fabricators, exchanges and with brokers and dealers in the U.S. were 49,098 tons, a decrease of 108,267 tons from the beginning of the year as reported by the Copper Institute. Stocks of refined copper throughout the entire world decreased 237,223 tons during 1973 reflecting increased consumption of the metal.

Copper is produced from mines in 62 countries according to data supplied by the U.S. Bureau of Mines. World production in 1973 totaled 7,856,681 short tons of copper (a number subject to revision and one that contains numerous estimates). Production in 1973 was nearly a half million tons greater than that of 1972 which was 7,329,378 short tons. In 1973 the U.S. was the largest producer recording 1,717,940 short tons, nearly double Canada's second place production of 899,474 short tons. Malaysia, the country with the smallest recorded production for 1973, is credited with 55 short tons. The ten largest copper producing nations in 1973, in decreasing order with respect to output, were: the U.S., Canada, Chile, Zambia, U.S.S.R., Zaire, Philippines, Peru, Australia and Papua New Guinea.

Geographically, the North American Continent accounted for 34 percent of the world's production; Africa, 21 percent; Europe (including the U.S.S.R.), 18 percent; the South American continent, 14 percent; and Asia and the Oceanic nations, 13 percent. Two geographically small areas of the world, the "Copperbelt" in Africa and the State of Arizona, account for a very significant portion of the world's copper production. The production of Zaire and Zambia amounting to 1,317,176 short tons, slightly over 18 percent of the world's 1973 copper production was produced in the small "Copperbelt" which is a narrow strip of land extending along the northern boundary of Zambia and along the southern boundary of adjacent Zaire.

The State of Arizona, with a 1973 production of 927,271 short tons, accounted for nearly 12 percent of the world total and more than any nation.

United States 1973 production of copper, as recoverable content of ore, was 1,717,940 short tons from 239,998,000 short tons of copper ore. This ore contained an average 0.53 percent copper or 10.6 pounds of copper per ton of ore. The 1973 production fell short of the 1970 record production by only 1,717 short tons; but was a 53,100 ton improvement over 1972's production. The 1973 production was valued at \$2,044,349,000 an all time record due to both improved production and record prices averaging 59.5¢ per pound. Nineteen seventy-three's production was obtained from a record high quantity of ore due to the steadily lower grade of material available for mining. The 1970 record production was produced from 32,264,000 short tons less ore than was mined in 1973. The 1970 ore averaged 0.59 percent copper.

New refined copper, as reported by copper refineries for 1973, was 1,698,337 short tons refined from domestic ores. Also 170,151 short tons of copper was refined by U.S. refineries from ores, concentrates, and partially processed copper materials from foreign mines. Secondary or recycled copper recovered from old scrap amounted to 441,841 short tons, 26 percent of the new copper produced in 1973. Imports of copper totaled 398,498 short tons and exports amounted to 220,266 short tons. Thus for 1973 there was a 178,232 short ton excess of imported over exported copper; slightly over 10 percent of new mine production and 7.3 percent of total U.S. copper consumption for the year.

For the last four years, copper production from both Arizona and the U.S. has not kept pace with the rest of the world. In the U.S. and Arizona alike, political and environmental controls have both increased the cost of development and the availability of deposits to develop. Environmental controls (control of air, water and land surface pollution) and land use planning, both unheard of in most copper producing countries, are added costs of development and production of American copper. As mentioned earlier, the U.S. producer copper price is indirectly related to the LME price which is a worldwide free market price. Thus copper produced in this country is sold based on world prices that do not take into account added production costs of environmental controls. Since the grade of ore that can be profitably mined, milled and refined is directly related to the cost of production, as production costs rise due in part to environmental controls the lower limit of ore grade must be raised, thus making millions of tons of lower grade material unmineable and worthless. As in the past, improved production efficiency has offset some increased costs.

Land use planning, a term often used for a form of governmental land usage control, is often so inflexible as to deny the availability of potential copper deposits from exploration, development and production. However, if properly used, land use planning can provide protection for potential mineral deposits from other surface uses such as housing developments. Both land use planning and environmental controls are likely to be continual factors in rising copper production costs.

In 1973, Arizona's copper mines produced 181,311,945 tons of copper ore containing 1,735,012,000 pounds (927,271 short tons) of copper worth \$1,021,314,814; 54.0 percent of U.S. mine production and more than any nation. That same Arizona



copper ore contained 102,376 troy ounces of gold; 7,164,988 troy ounces of silver and 37,657,000 pounds of molybdenum worth an added \$37,710,570. Utah ranked second to Arizona, producing copper ore containing 256,507 short tons of copper; New Mexico third with 204,742 short tons and Montana fourth with 132,466 short tons.

Copper producing mines in Arizona are located in what is known as the basin and range province. The October, 1974, issue of the Directory of Active Mines in Arizona, published by the Arizona Department of Mineral Resources, lists 27 mining properties operated by 13 companies as producing copper. They are: the Twin Buttes mine, operated by Anamax Mining Company; the Mission, San Xavier and Silver Bell mines, operated by Asarco (American Smelting and Refining Company); the Copper Cities and Miami mines operated by Cities Service; the Bagdad and Pima mines, operated by Cyprus Mines; the Esperanza, Mineral Park and Sierrita mines, operated by Duval; the Emerald Isle mine operated by El Paso Natural Gas; the United Verde mine, operated by the Big Hole Mining Company; the Inspiration, Christmas and Ox Hide mines, operated by the Inspiration Consolidated Copper Company; the Ray mine operated by Kennecott Copper Corporation; the San Manuel and Superior (both underground) mines operated by Magma Copper Company; the Zonia mine, operated by the McAlester Fuel Corporation; the Copper Queen (underground), Lavender Pit, Morenci and New Cornelia mines, operated by Phelps Dodge; and the Bluebird and Old Reliable mines, operated by Ranchers. In addition, there are seven mining operations producing silica flux some of which contains copper for the copper smelters. The production of these various mines is tabulated in Tables I and II.

Included in the Arizona copper mines are 16 of the nation's 25 largest copper mines. They are: Magma's San Manuel, second only to Kennecott's Utah Copper mine at Bingham Canyon, Utah; Phelps Dodge's Morenci, 3rd; Kennecott's Ray mine, 6th; Cyprus' Pima mine, 7th; Duval's Sierrita, 9th; Anamax's Twin Buttes, 11th; Phelps Dodge's New Cornelia, 12th; Inspiration's Inspiration mine, 13th; Asarco's Mission, 14th and Silver Bell, 17th; Cities Service's Copper Cities, 19th; Duval's Mineral Park, 20th; Magma's Superior mine, 21st; Phelps Dodge's Copper Queen, 22nd; Cyprus' Bagdad mine, 24th; and Duval's Esperanza, 25th.

Those companies mining copper must continually progress toward discovering new deposits, more efficient and environmentally more pleasant operations and further technical advancements. The business of mining copper in Arizona is not a stagnant one. The following is a very brief description of the plans and activities of Arizona's copper producers.

#### HECLA - EL PASO NATURAL GAS

The Hecla Mining Company and El Paso Natural Gas Company are the joint owners of the Lakeshore mine, presently under development on a copper deposit located on the Papago Indian Reservation south of Casa Grande. Hecla is the operating company. The orebody, actually two orebodies, one of oxide copper minerals and the other of sulfide copper minerals, will be mined by underground methods. The sulfide ores will be concentrated, roasted to release sulfur, leached with acid made from the released sulfur, and electrowon to produce copper cathodes. The oxide ores will be leached by acid also made from sulfur released from sulfide ore roasting and the leached copper will be precipitated as cement copper using sponge iron produced from the residue of the leaching of the roasted sulfide ores. These recovery

methods were chosen so that waste products from one stage of processing are used as required processing ingredients in another stage.

Over 45,000 feet of underground openings (shafts, tunnels, drifts, etc.) had been driven by the end of 1973. Two parallel declines (downward sloping shafts) driven at a minus 15° slope were essentially completed during 1973. These declines serve as the main entries to the underground orebodies. One of the declines provides rail hoisting service to the mine men, supplies and equipment. The other decline will be equipped with a conveyor belt to move ore from the underground primary crusher and waste to the surface.

Production is scheduled to start from the mine during late 1974. When the mine and both the sulfide and oxide ore processing plants are operating at full capacity, expected in 1975, the operation will be capable of producing 69,000 tons of copper annually.

#### BIG HOLE MINING COMPANY

"Old mines never die" is the preface to the story of the Big Hole Mining Company. The company operates those mines generally referred to as the United Verde mine or the Jerome mines of the United Verde Branch of Phelps Dodge. When the mines in Jerome were "shut down" in the early 50's by Phelps Dodge as exhausted, a little high grade ore, in pockets too small to be profitably mined by a company as large as Phelps Dodge remained. The Big Hole Mining was contracted by Phelps Dodge to mine the remaining ore and recover any leachable copper from the extensive dumps. This, Big Hole does and ships the ore and leach precipitates to Phelps Dodge's Douglas smelter.

Thus by recovering the last bit of valuable metal from an already established mine, the Big Hole Mining Company is furthering the true meaning of the word conservation.

#### McALESTER FUEL

Prior to April the McAlester Fuel Company operated an open pit mine, the Zonia, 20 miles west of Prescott near Kirkland. Oxide ore was mined, piled in heaps and leached with sulfuric acid. Copper was recovered in precipitates. Following many months of preparation, what was considered, at that time, to be the largest non-atomic blast in the world was set off the morning of April 19. The blast utilized 4,125,000 pounds of explosive to break and shatter the copper deposit to prepare for an in situ (in place) copper leaching operation. The Zonia blast exceeded by 125,000 pounds of explosives the blast at Ranchers Old Reliable mine in 1972.

The blast area covered 10 acres. After the blast, a sulfuric acid sprinkler system was set up and leaching began. By January, 1973, the leaching operation was recovering an average of 5,000 pounds of copper daily.

## RANCHERS

The Ranchers Exploration and Development Corporation operates the Old Reliable mine in the Galiuro Mts. and the Bluebird mine in the Globe-Miami area. Ranchers' Bluebird operation was the first to directly recover copper in cathodes from leach solutions produced by leaching heaped ore from their open pit mine. The company announced in February of 1973 that it had reached a preliminary agreement in principle with Mitsubishi International of Japan for a possible joint venture to expand the Bluebird mine. The companies have developed an economic model for upping the mine's present production of 7,500 tons of cathode copper per year approximately four times. If the test work is successful, the agreement provides that Mitsubishi will contribute about \$20,000,000 and own a 30% interest. Ranchers, who will contribute existing production facilities, will receive \$3,750,000 in cash and own 70% of the venture.

The Old Reliable mine represented a pioneer effort in copper production. The mine, long considered "mined out", still contained nearly 4 million tons of rock containing .8% copper. The old underground workings and some additional tunnels constructed for the purpose were loaded with 4 million pounds of explosives and the whole deposit shattered. The shattered rock was then terraced and a sprinkler system installed which would distribute a weak sulfuric acid solution over the entire surface of broken rock. The acid solution flows through the broken rock, dissolving the copper and carrying it to precipitation tanks where the copper is removed from the solution. The solution flows through the deposit at a rate of approximately 1,000 gallons per minute. An average of 500,000 pounds of copper is recovered monthly.

Rainfall can, as it did in 1973, cause a unique problem at both the Bluebird and the Old Reliable mines. Both mines recover copper by leaching; from man made ore piles (heap leaching) at the Bluebird and in situ (in place) at the Old Reliable. Significant rainfall mixed with the sprinkled acid solution and diluted the acid to a point where the leaching action nearly ceased for a short time.

## CITIES SERVICE

Cities Service operates the Copper Cities open pit mine and concentrator, the Miami mine as an underground in place leaching project and is developing the Miami East underground mine, all as part of their Miami Copper Operations at Miami. Their Pinto Valley Operation is developing an open pit copper property eight miles west of Miami.

## MIAMI COPPER OPERATIONS

During the 60's ore of a mineable grade in the Miami underground mine was exhausted. Yet, in any mining operation, scattered small high grade pockets remained unmined as does much rock of only marginal value. In an attempt to recover this remaining copper still contained in the old Miami mine, the entire underground maze of mine workings were flooded with a leaching solution. Now, approximately ten years later, copper from the rock left behind when mining stopped is still being recovered by leaching.

Development is continuing at the high grade Miami East orebody located 2,500 to 3,700 feet underground in the Miami area. The ore is located in the down-faulted section of the old Miami-Inspiration orebody that supported underground mining operations in the area for many years. Ore production is expected to start from the new orebody in 1975 and is scheduled to reach a full capacity level of 2,000 tons of ore per day by the end of 1975.

#### PINTO VALLEY OPERATIONS

Cities Service's mine development program at Pinto Valley continued throughout 1973. The Pinto Valley mine will operate as an open pit mine with a daily capacity of 40,000 tons of ore by the end of 1974. Capacity at start up is expected to be 20,000 tons of ore per day. The mine and mill will produce sulfide copper concentrates which will be smelted by Inspiration. Byproduct molybdenum will also be produced.

Some 60 million tons of overburden will have to be removed to fully develop the mine. During preproduction stripping and later during mining any oxide copper ores found will be stockpiled for future treating. A number of archeological sites have been discovered during the development of the property and are being investigated by archeologists from the Arizona State Museum and archeology students from the University of Arizona.

#### INSPIRATION

The Inspiration Consolidated Copper Company operates open pit mines and a milling, smelting and rod fabricating complex at Inspiration, known as the Inspiration Division. The company also operates an open pit mine at Christmas. The mines at Inspiration produced sulfide ore which is milled, concentrated and smelted, oxide ore which is leached and dual process ore (both oxide and sulfide) which is first vat leached and then milled, concentrated and smelted.

Construction of Inspiration's \$54,000,000 air pollution control project continued through 1973 and has been completed. The project has amounted to the building of a completely new smelter. Principle components are the largest electric smelting furnace in the world, new siphon-type converters, a waste gas cleaning plant and a sulfuric acid plant. Although the new smelting facility is to completely replace the smelter used in the past, the old smelter will be kept intact, in operating order in case of a national emergency that might require additional smelter capacity on short notice.

To meet State and Federal air quality standards, Inspiration concluded that the production of sulfuric acid from the sulfur dioxide contained in waste gases was the only feasible approach to sulfur-dioxide removal. Sulfuric acid production necessitates the collecting of highly concentrated sulfur-dioxide gases, but those gases released from the existing Inspiration smelter were not of a high enough concentration for sulfuric acid production. It was these and additional technological reasons and other economic considerations that led to construction of a new smelting system; a system adaptable to the production of sulfuric acid from waste gases. The new facility was built at the western end of the old smelter to



take advantage of much of the existing equipment and service auxiliaries. Once initial "start up" difficulties are overcome and the new smelter is fully operational, it will meet the most stringent of State and Federal air quality standards.

The large quantity of sulfuric acid produced by Inspiration's new plant will be disposed of in part, through the company's new Willow Springs \$2,300,000 heap-leaching project scheduled for start up during 1974. Copper production from this project will eventually reach an annual rate of 10 million pounds. That portion of acid produced from ore and concentrates smelted by Inspiration for other companies will be returned to those companies. Still more of the acid will be sold to Anamax Mining Company for use at their new oxide ore treatment plant.

#### ANAMAX

Anamax Mining Company is a 50-50 partnership between the Anaconda Company and American Metal Climax (Amax). Anamax operates the Twin Buttes open pit copper mine near Tucson.

In June of 1973, Amax acquired the Banner Mining Company, owner of extensive mineral properties in Pima County, including the Twin Buttes copper mine which was under long term lease to the Anaconda Company. At the same time, the 50-50 partnership between Amax and Anaconda was formed creating the Anamax Mining Company to operate, further develop and expand the Twin Buttes mine. Copper production from the mine is split equally between the two parent companies to be marketed individually.

By 1976, the Anamax partnership expects to increase annual production at Twin Buttes to average approximately 120,000 tons of copper annually. Amax, as part of the partnership agreement, is investing \$93,000,000 for mine development over a three year period. In addition, both companies are sharing equally in the expenditure of approximately \$40,000,000 for mine development equipment, including new transporting and crushing units, \$15,000,000 to increase the sulfide ore concentrating mill capacity from 30,000 to 40,000 tons per day and approximately \$70,000,000 for the construction of an oxide plant. The new plant to treat oxide ore is scheduled to come on stream in 1975 and will produce copper cathodes from oxide copper ore through a leach-electrowinning process.

#### KENNECOTT

Kennecott operates an open pit copper mine known as the Pearl Handle Pit, a silicate-leach-electrowinning plant and a smelter along with a supporting mill and related facilities as their Ray Mines Division in the Ray-Hayden area.

Installation of a sulfur dioxides air quality control system at their Hayden smelter was completed during 1973 and fully operational by June of this year. (Both Kennecott and Asarco operate smelters at Hayden). The system includes an expanded sulfuric acid plant, improved converter hoods and gas collectors and a complex computer control system.

To avoid returning converter slag, a molten copper bearing waste from converter operation, to the reverberatory furnace where the high sulfur content of the slag would increase air quality problems, the slag is hauled in huge (three times larger than usual) slag pots to earthen cooling pits. There the slag is allowed to cool and harden for eventual return to the crushing, grinding and flotation processes to recover additional copper. The recirculation of converter slag in this manner not only reduces air contamination, it provides for increased recovery of the copper resource.

The silicate ore leaching plant is to be enlarged by 40 percent, from 10,000 to 14,000 tons of ore per day, at a cost of \$7,000,000 to consume acid produced by the expanded acid plant. Copper production from the vat leach plants will thereby be increased from 19,000 to 24,500 tons annually.

The Mineral Creek flood water diversion tunnel and diversion dam were completed late in 1973. During heavy rainfall periods, the increased stream flow would cause flooding in the mine areas and pick up polluting chemicals in the process. The diversion project carries the stream flow around the mine through a three and one-half mile long, 16 foot diameter tunnel.

The Division is presently studying the feasibility of major expansion of the entire Ray Mines operation. Results of the study are to be expected during the second half of 1974.

#### DUVAL

Duval Corporation is the mining subsidiary of Pennzoil and operates three large open pit mines with their associated milling and support facilities in Arizona. Duval operates the Esperanza mine near Tucson and the Mineral Park property near Kingman. Duval Sierrita Corporation, wholly owned by Duval, operates the Sierrita near Tucson.

The company continued with a research effort on their patented, pollution-free copper recovering technique, called the CLEAR Process. The process is being implemented with the construction of a full scale plant with an operating capacity of 32,500 tons of copper produced per year. While construction of this \$25,000,000 facility is in progress, the company will continue to operate its CLEAR pilot plant to gain additional operating data. When completed, the plant will treat concentrates from the Esperanza mine.

#### Esperanza

Duval's Esperanza mine, a copper-molybdenum open pit operation, resumed operations early in January of 1973 after closing in December of 1971 in order to reduce the stockpile of copper concentrates which had built up during the shutdown of Asarco's smelters during the 1971 copper industry strike. Although the Esperanza operation continued uninhibited throughout that strike, the Asarco smelters which process Esperanza's concentrates were shut down. Reduction in allowable capacity due to air quality control regulations prevented the Asarco smelters from increasing production after the strike to treat the backlog of Esperanza concen-

trates. By mid-January of 1973 the concentrate inventory had been reduced to manageable levels. However, in order to reduce the inventory, Duval was forced to export nearly 36,000 tons of copper concentrate to Japan and West Germany.

Plant modifications initiated during the shutdown made possible a 25% increase in production. Upon return to operation the company added 340 employees to its payroll.

#### Duval Sierrita

In 1966 the General Services Administration (GSA - the materials supply agency of the Federal Government) initiated a program to encourage additional domestic production of copper. Duval Corporation entered into negotiations with the GSA for development of the Sierrita copper-molybdenum property under the program. A development contract was signed between Duval and the GSA in November of 1967. Out of the total \$100 million allocated to GSA for the program, the Duval Sierrita project was assigned \$83 million as an advance against future delivery of copper to the government at a fixed price of 38 cents per pound. Total cost for the development of the property approached \$200 million.

So long as Duval has a positive cash flow (in other words, sells sufficient copper, molybdenum and precious metal byproducts to cover fixed and operating costs) it must sell its output to GSA and must meet minimum annual commitments to the GSA. The contract which ends on June 30, 1979, calls for the delivery of a minimum of 12 million pounds of copper in 1974 and 147.1 million pounds over the remainder of the agreement (1975 - June 30, 1979). The molybdenum and byproduct precious metals are sold by Duval on the open market along with whatever copper must be sold to meet operating costs.

The Sierrita operation mined nearly 30.5 million tons of ore in 1973, a daily rate of 83,500 tons; more ore per day than any other Arizona copper mine.

#### Mineral Park

Duval's Mineral Park Mine near Kingman operated throughout 1973 with few problems. Ore production averaged 17,600 tons per day which was slightly less than full capacity due to problems related to the handling of wet ores and the availability of ammonium nitrate explosives. More efficient mill tailings handling equipment was installed during 1973.

#### NEWMONT MINING CORPORATION

The Magma Copper Company, consisting of a high grade underground mine and concentrator (mill) at Superior and a large underground mine, concentrator, smelter and continuous casting plant for copper rods at San Manuel, is wholly owned by Newmont Mining Corporation.

## San Manuel

Magma's San Manuel mine was the largest producer of copper in Arizona again in 1973 and second only to Kennecott's Utah Copper Division at Bingham Canyon, Utah, in the United States. Mine production continued without interruption throughout 1973. However, smelter production was hampered early in 1973 by problems with anode casting and by the necessity of installing new water-cooled converter hoods as part of the company's air quality control program. A manpower shortage that existed through much of the year had a limiting effect on the output of the mine, smelter and refinery, with the result that production, although setting new records, did not reach planned levels. Due to the difficulties in reaching planned production levels, the company was required to envoke a force majeure cutback of scheduled refined copper shipments in August, September and October of 1973.

Magma announced that they will spend at least \$3 million on a neutralization plant and related facilities to dispose of sulfuric acid which will be a byproduct of the company's new \$50 million sulfuric acid plant, designed to convert to acid some of the sulfur dioxide gas produced during the smelting process. The Magma acid plant construction schedule calls for completion of the project in the summer of 1974. When completed the plant is expected to produce about 2,000 tons of sulfuric acid a day when in full operation. Magma will sell between 360,000 and 500,000 tons of the acid to Anamax Mining Company annually. Anamax will use the acid to leach oxide copper ore at their Twin Buttes mine. The remaining acid will be sent through the neutralization plant where it will be neutralized with pulverized limestone and water to produce gypsum. The gypsum will be disposed of in the mill tailings ponds.

The Magma smelter has been chosen by the Smelter Control Research Association (SCRA) as a test site for a proposed experimental sulfur dioxide removal plant to control sulfur dioxide generated by reverberatory furnaces. Sulfur dioxide is generated by two sources in the typical copper smelting operation: the reverberatory furnaces and the converters. While all seven of Arizona's smelters have either built, or are building, acid plants to control sulfur dioxide produced by the converters, they have not yet found a way to control gases from the reverberatory furnaces. However, the majority of sulfur dioxide produced in the smelting operation is part of the already, and/or soon to be, controlled converter gases.

## Superior

At Superior, the mine was shut down during July, 1973, to enable transfer of haulage and hoisting operations to the new tunnel and shaft. Since August, 1973, the new facilities have been in operation and have brought ore production from the deeper high grade orebody to a daily rate of nearly 3,000 tons of ore, about double the previous rate. The planned production rate of 3,300 tons of ore daily is expected to be reached during 1974, as mine development proceeds to the goal of providing sufficient working places.

The Superior ore contains 4.2 percent copper, and by today's standards is considered very high grade ore.



## ASARCO

Asarco (American Smelting and Refining Company) owns and operates the Mission, Sacaton, San Xavier and Silver Bell copper mines and the Asarco Hayden smelter in Arizona.

### Mission Unit

The Mission Unit is Asarco's largest mining property, and is located near the famous Mission San Xavier del Bac, southwest of Tucson. The mine takes its name from this mission which was built in the 1700's.

The Mission mine operated at near capacity throughout 1973 at a rate of 22,500 tons of ore per day. Approximately three tons of waste had to be removed for each ton of ore produced. The operation is distinctive in that two companies, Asarco and Cyprus Pima, are mining adjacent portions of the same orebody.

A new computer program that analyzes the operation of open pit mines has been successfully used to optimize the working of the Mission mine. The program is called ORE - Optimum Resource Extraction. The program exploits a computer built model of the orebody to be developed. The computer model is derived from drill hole data, geologic information, topographic contours and general economic factors affecting pit design. The resulting model, which includes an inventory of mineral content and assay, as well as haulage cost for every block of ore in the deposit, is used to determine the best practical pit form, including bench contours and haul roads.

### San Xavier Unit

The San Xavier Unit of Asarco is a new copper recovery plant which will produce 15,000 tons of copper contained in precipitates per year. The precipitates contain 80 to 82 percent copper. The construction of the plant was completed on May 1, 1973, and dedicated by Asarco on June 14, 1974. Construction of the vat leaching facility took 13 months at a cost of approximately \$13 million. The unit is the nation's fourth largest producer of copper by vat leaching.

The vat leaching operation recovers approximately 16 pounds of copper from each ton of oxide copper ore mined by Asarco from their leased San Xavier mine on the Papago Indian Reservation. The two non-contiguous orebodies that make up the San Xavier mine contain approximately 10,600,000 tons of oxide ore with a .98% copper average grade. The mine lease with the Papago Indian Tribe requires the minimum payment of \$600,000 annually to the Tribe.

Production of the cement copper precipitates involves two distinct processes: leaching the copper from the crushed ore in vats with a dilute solution of sulfuric acid and the precipitating of copper from the leach solution using de-tinned scrap tin cans. The resulting cement copper (concentrate) is shipped to Asarco copper smelters at Hayden in Arizona and El Paso, Texas.

The new plant will consume about 50,000 tons of sulfuric acid per year. The acid will come from Asarco's new acid plant at the Hayden smelter. The acid plant

at the smelter was constructed as an air pollution control facility and recovers sulfur dioxide from the smelter smoke. The production of the cement copper precipitates also consumes about 15,000 tons per year of shredded "tin cans" which are presently collected at municipal waste recycling centers in Texas.

#### Silver Bell Unit

Asarco's first important copper mine in Arizona was developed at Silver Bell, northwest of Tucson. Asarco's current operations at Silver Bell are two porphyry copper open pits, the El Tiro and the Oxide. Current operating capacity is about 11,000 tons of ore per day. Nearly all of Silver Bell's copper concentrate output is shipped to Asarco's Hayden smelter.

The company's previous estimates of ore reserves were decreased by 36 percent in 1973. The previous estimate included possible ore in the fringe areas of the mines. Closer examination showed mineralization in these fringe areas to be below economic limits. The mine is estimated to be closed in approximately eight years.

#### Sacaton Unit

Asarco's new Sacaton Unit mine was dedicated in March of 1973. Construction costs over a period of slightly more than two years amounted to over \$40 million. Named for the nearby Sacaton Mountains, the unit employed over 600 people at the peak of construction. The permanent work force is nearly 400.

The discovery of the porphyry copper deposit outcrop was made by Asarco geologists in 1961. Subsequent exploratory drilling indicated two orebodies with a combined reserve estimated at 47,500,000 tons of ore. A relatively shallow west orebody, which is expected to produce approximately two thirds of the ore during its ten year life, is being mined by open pit methods.

A deeper east orebody will be mined by underground methods. Present plans are to mine this deeper orebody by block-caving. Underground development at a depth of 1800 feet is expected to begin in the third year of open pit operation. Ore production from the underground operation is to begin in 1980.

At the projected metallurgical recovery rate, scheduled production of copper from the open pit operation is 21,000 tons of copper per year, based on an average ore grade of 0.76 percent copper and mine production of 9,000 tons of ore per day. Before minable ore could be reached at a depth of approximately 300 feet, nearly 40 million tons of top soil and overburden were removed.

The topsoil removed during mining is kept separate from the rest of the overburden and some of it is being used to cover the rock dump faces and tailings dam slope to facilitate revegetation.

When mining is completed, reclamation plans call for removing the plant and covering the plant site and all disposal areas with the segregated desert alluvium, which will then be reseeded.

The operation presently consists of an open pit mine and a concentration mill with numerous support and maintainance facilities. The copper concentrate produced at the mill is shipped to Asarco's smelter in Hayden.

#### Hayden Smelter

Asarco operates a copper smelter at Hayden which has a rated input capacity of 960,000 tons of material.

The Hayden copper smelter was modified in 1973 by the addition of an anode casting plant at a cost of approximately five million dollars. This eliminates the casting of blister copper cakes, previously remelted and cast into anodes at the refinery.

For the purpose of reducing sulfur dioxide emissions from the Hayden smelter, a sulfuric acid plant was installed in 1971. During 1973 a 1000 foot stack was erected for better dilution and dispersion of the weak sulfur dioxide gases that cannot be handled by the acid plant.

#### CYPRUS MINES CORPORATION

The Cyprus Mines Corporation wholly owns or controls, as subsidiaries, the following four mining companies in Arizona: Cyprus Bagdad Copper Company, Cyprus Bruce Copper & Zinc Company, Cyprus Johnson Copper Company and Cyprus Pima Mining Company.

#### Cyprus Bagdad

At the Cyprus annual meeting in May, 1973, the shareholders voted to merge Bagdad Copper Corporation into Cyprus and the merger was completed in June. Cyprus is now the sole owner and operator of the Bagdad mine. The basic reason for the merger was to facilitate expansion of the Bagdad operation and, therefore, benefit the shareholders of both companies. Ore reserves at Bagdad are considered large: 300 million tons averaging 0.49 percent copper are proven, and additional drilling should prove several more hundreds of millions of tons. Immediately following the merger, Cyprus undertook a major expansion feasibility study of the mine and mill and possible construction of a smelter and refinery. A smelter might supply the company with a much more flexible marketing position. It is hoped that the decision to proceed with a major expansion will be made about mid-1974. If the decision is to expand, the company expects that detailed engineering and construction will require about two and a half years.

Bagdad now consists of an open pit mine supplying ore to a mill producing copper and molybdenum concentrates, an oxide-copper leaching system which produces high-purity cathode copper through liquid ion exchange and facilities for its 500 employees and their families.

By the end of 1973, Bagdad had accumulated concentrates containing approximately 3,000,000 pounds of copper which were stockpiled due to smelter capacity problems. A smelting arrangement has been made to treat the entire stockpile plus

all of 1974's production.

Bagdad has ceased copper powder production because of the shortage and high price of the purchased raw materials.

### Cyprus Pima

Cyprus is the operator and owns 50.01 percent of the Pima mine, located near Tucson. The mine is primarily a copper concentrate producer with molybdenite and silver as valuable byproducts. The remainder of ownership is held by Union Oil Company of California and Utah International Inc. The copper concentrate produced is shipped to Phelps Dodge's smelter at Douglas and Magma's smelter at San Manuel. The major portion of the recovered copper is returned to Cyprus Pima for their own marketing.

At the end of 1973 Pima ore reserves amounted to 221 million tons with an average grade of 0.49 percent copper, sufficient for about 11 years of operation at the present mining rate. Exploratory drilling was continued during 1973 in order to evaluate a potentially profitable expansion to the east and southeast of the present pit. If development proves feasible this expansion will significantly extend the life of the operation.

The new expanded mill using semi-autogenous grinding mills (a grinding method that avoids the use of expensive and often in short supply iron balls and rods), installed early in 1973, functioned satisfactorily throughout the year and resulted in increased production and a reduced per ton milling cost.

In recognizing the necessity of solving air pollution problems resulting from the smelting of copper concentrate and maintaining a viable smelting facility for their concentrates, the company decided to assist financially in modifying the Phelps Dodge smelter at Douglas to bring it in conformity with certain requirements of Arizona's air pollution regulations. Pima consequently lent \$10,000,000 to Phelps Dodge for the purpose. The Douglas smelter processes the major portion of Pima's concentrates.

### Cyprus Johnson Copper Company

As the result of drilling and metallurgical studies on Cyprus properties in the Johnson Camp area, a mineralized area has been shown to be of commercial significance and development of a mining operation is proceeding. The proven reserves consist of 14.7 million tons of oxide copper ore with 0.80 percent total copper content. Construction of the plant is underway. Mining operations are scheduled to commence in early 1975.

The oxide ore, which comes right up to the surface, will be mined by open pit methods at a rate of about 4,000 tons per day. The ore will be hauled to dumps where it will be leached to recover from 25,000 to 27,000 pounds of copper per day.

While the amount of daily production is comparatively small by today's "big mines" standard, the monetary investment is also considered small. Construction costs are estimated to be about \$6 million.



## Cyprus Bruce Copper & Zinc Company

Cyprus owns and operates the Bruce (formerly the Old Dick) mine near Bagdad. The mine is a small high-grade underground copper-zinc deposit with a concentrator and support facilities. The operation produces and sells copper and zinc concentrates. Due to zinc smelter capacity curtailments and shutdowns, the company experienced some difficulty in disposing of their zinc concentrates. Known ore reserves of 467,000 tons with an average grade of 3.72 percent copper and 12.4 percent zinc, will sustain mining at the present rate for about five years.

### PHELPS DODGE

Phelps Dodge is the largest producer of copper in Arizona. The company operates three large open pit mines: the Morenci mine at Morenci, the New Cornelia mine at Ajo and the Lavender Pit at Bisbee; three smelters: at Douglas, Ajo and Morenci; one underground mine, the Copper Queen at Bisbee and is developing an open pit mine, the Metcalf, near Morenci, and an underground mine near Safford, all in Arizona.

#### Copper Queen Branch

The Copper Queen Branch consists of various underground mines collectively referred to as the Copper Queen mine, the Lavender Pit open pit mine, a mill and concentrator and various support facilities.

First announced in 1967 it has been well aired that the end of mining operations in Bisbee by Phelps Dodge was in sight. Mining in the Lavender Pit had been scheduled to cease by the end of 1973. Underground mining at the Copper Queen had been scheduled to stop shortly thereafter. But prices change, costs change, and technology advances, and it's now expected that the Lavender Pit will continue to produce until at least the end of 1974.

At the annual stockholders meeting in May, 1974, it was announced that the company was planning to process through the concentrator material from the lean ore dumps at Bisbee mixed with higher grade ore from the underground mines. If this proves feasible and not too costly, they may be able to continue production at Bisbee for another year or two beyond 1974 depending also on copper prices.

Phelps Dodge has launched an exploration program at Bisbee aimed at the old Shattuck mine it had recently acquired from Shattuck Denn Mining Company. The program is expected to cost about \$500,000 over a two year period. The program will include rehabilitation of the old Shattuck shaft and extensive core drilling to investigate the geologic formation from which most of the underground production has come in recent years but which was of no value when the Shattuck mine was operating over fifty years ago.

#### New Cornelia Branch

The New Cornelia Branch of Phelps Dodge at Ajo consists of an open pit mine, concentrator and smelter. The open pit mine is one of two in Arizona which use railroads for hauling ore and waste in the pit.

The company's smelter is operating under an interim permit issued by the State Air Pollution Control Hearing Board conditioned upon carrying to completion air quality control programs now underway. The permit extends to January 3, 1975, by which time the program is to be completed.

At the Ajo smelter, construction of new facilities to control sulfur dioxide and particulate emissions were substantially completed in 1973, except for some modifications shown to be necessary by initial operations. Total expenditures at Ajo for air pollution control will amount to nearly \$31 million when facilities are completed and operating.

#### Morenci Branch

Operations at the Morenci Branch of Phelps Dodge include an open pit mine, concentrator, a smelter and related support facilities. The Morenci mine, along with the New Cornelia, are the only two open pit mines in Arizona using railroads for the hauling of ore and waste in the mine.

In action similar to that taken at Ajo, the State Air Pollution Control Hearing Board issued an interim operating permit for the Morenci smelter conditioned upon carrying to completion air quality control programs now underway. Like the Ajo permit, the one for Morenci expires in January, 1975, when facilities presently under construction will be operational. At that time a permanent operating permit will be issued.

As of year end 1973 nearly \$53 million had been spent at Morenci for air quality control equipment. The total cost of the Morenci program is estimated at \$92 million. The program includes substantial modifications of waste gases handling equipment and construction of a variety of new equipment, including a new 2,500 ton per day sulfuric acid plant.

The sulfuric acid to be produced from the smelter waste gases will be disposed of by using it to recover, by leaching and precipitation, on a portion of the small amount of copper otherwise left in Morenci and Metcalf waste dumps and tailings.

As a result of the large capital investment, \$92 million, required to implement air-quality control requirements, the Industrial Development Authority of Greenlee County voted to lend \$60 million to Phelps Dodge to help finance pollution control facilities under construction at Morenci. Financing of the loan will be through tax-free pollution control revenue bonds. Phelps Dodge will repay the loan through the year 2003.

The Metcalf mine, under development by Phelps Dodge near Morenci, will be capable of producing 60,000 tons of copper annually, commencing early in 1975. In 1973, removal of overburden continued as did construction of the concentrator and related facilities.

When production begins at the Metcalf mine and concentrator, Metcalf concentrates will be smelted at Morenci, largely displacing the concentrates from the company's Tyrone mine in New Mexico which are presently treated at the Morenci smelter. A new smelter is under construction in New Mexico to treat the production from the Tyrone mine.

## Douglas Reduction Works

Phelps Dodge operates a smelter in Douglas which presently treats the copper concentrates produced at the Copper Queen Branch and those from a number of other mining companies.

At the Douglas smelter, an estimated total of \$17 million is to be spent for air quality control facilities. The Douglas emissions control program includes a permanent partial curtailment of operations thus reducing the quantity of material and, therefore, the quantity of copper that can be legally produced.

## Safford Branch

The preliminary development program at Phelps Dodge's deep orebody at Safford continued in 1973. Total expenditures by year end 1973 have amounted to \$14,400,000 at the project.

Additional development work during the next two to three years has been authorized with expenditures expected to exceed \$30 million. This will include deepening the existing shaft on the property, sinking a new shaft, underground development work and erection of additional surface facilities. The increased work will be able to absorb many of the company's employees from Bisbee where jobs will eventually be partially phased out.

Before production can begin, two additional shafts will have to be sunk, further underground development work completed and a concentrator built.

The Safford orebody contains an estimated 400,000,000 tons of ore with an average grade of 0.72% copper.

Copper mining in Arizona is more than tons of ore, pounds of copper and prices per pound. It's jobs for people, 25,500 of them, earning an average of \$11,426 a year. Arizona copper miners produce an average of 4,872 tons of ore and 48,530 pounds of copper per production worker per hour worked; almost 10 percent more than the national average. Those 25,500 copper workers are not the only Arizonans benefitted by our copper industry. It would indeed be difficult to find any Arizonan whose life is not benefitted by the State's copper industry.

Edward H. Peplow, Jr., writing for the October, 1974, issue of Phoenix Magazine has produced an excellent discussion of copper's impact on Arizonans in an article entitled, "The Giant is Measured." There he summarizes the results of a recent study by one of Arizona's foremost economic analysts, Dr. George F. Leaming, of the Arizona Economic Information Center on the direct and indirect impact of the copper industry in Arizona.

The report, Mr. Peplow writes, shows the dollars direct and indirect impact of the copper industry to average \$3,144,317,000 per year over the last three years (1970-1972, the last period for which data was available). In Mr. Peplow's words:

"The next logical question is how one escalates \$947,557,000, the worth of copper produced (average 1970-72), to \$3.14 billion. A lot of things have been written about money. One of the more ineloquent, but most apt, is that money is like fertilizer: it does the most good when it is spread widely. The copper dollar, then, is shown by the above figures to be a truly fructifying factor in Arizona's economy.

"First, there are the direct impacts, which Leaming shows to average \$519,357,000 a year over the period 1970-72. This is composed of \$227.6 million of personal income received by Arizonans from the copper industry; \$228.9 million of business income; and \$65.8 million of income, or taxes, to state and local governments.

"Then there are the indirect impacts, which Leaming says total \$2.6 billion plus per year. He uses what economists call multipliers. There is an analogy of sorts with a stone dropped in a pond creating outward spreading ripples. The question, of course, is how far away from the point of impact is it valid to try to measure the ripples.

"Dr. Leaming measured them only over the course of a year. For every increase or decrease of \$100 in personal income paid by the copper industry to its employees, pensioners or stockholders within the state, total personal income in Arizona changes by \$202 (\$100 directly and \$102 indirectly). By the same token, business income changes by \$349 for every \$100, and state and local tax revenues change by about \$36.

"The multipliers used by Leaming are generally accepted as valid, erring, if at all on the conservative side. There are other respected economists who argue that Leaming is too cautious, that dollars turn over much faster in Arizona, and that the effects of a copper mine expansion in Greenlee County, for example, are felt in Maricopa County much more quickly and last much longer than Leaming shows.

"Leaving the intricacies of that argument to the economists, the simple facts are that the state's two major metropolitan areas, Phoenix and Tucson, derive the lion's share of the indirect impacts of the copper dollar. Leaming estimates that about 30 percent of the new business income generated accrues to the immediate mining community, the balance to the metropolitan areas. Phoenix, as the state's business and financial center, could expect 50 percent, Tucson 20 percent.

"The last full year for which Leaming's study, "The Copper Industry's Impact on the Arizona Economy," has figures is 1972. In that year he shows that the industry made purchases of goods and services in the metropolitan Phoenix area totaling \$94.8 million, in the Tucson area of \$97.5 million and in non-metropolitan mining counties of \$69.8 million.

"Overall, the industry's purchases of goods and services (direct impacts as business incomes) within Arizona in 1972 totaled some \$263.7 million, and the variety of those direct purchases is broad. The largest category was wholesale trade, which grossed \$100.7 million. Next was contract construction, with \$50.8 million, then public utilities with \$6.2 million, followed by manufacturing with \$38.7 million and transportation with \$16 million.



"Translated into terms of people, this means that a lot of wholesale distributors in the Phoenix area derive substantial parts of their incomes from sales to the copper industry. A man who lives at New River, for example, drives a delivery truck loaded with machinery parts for a Phoenix distributor. Each week he makes a four-day swing through the southern part of the state, calling at the mines and filling orders. The dollars with which he is paid originate far from Phoenix, but he is paid in Phoenix and he spends most of his earnings in Phoenix. The same is true of the people who staff the stockroom in the Phoenix headquarters; the clerks, secretaries and all the other personnel who work for that distributor.

"Take, for example, the salesmen who travel for that company who are based in Phoenix, yet they travel constantly throughout the mining areas. They buy cars in Phoenix; they buy gasoline all over the state; they stay in hotels; they patronize restaurants; and they entertain. A lot of those expenditures commonly are accumulated under the heading of tourism, but they are directly attributable to the presence and activity of the copper industry. About one and a quarter million dollars were spent on lumber and wood products, shown under the category. This means that a certain number of employees of the forest industry of the northern parts of the state are paid with copper (industry generated) dollars."

The list of those industries and their workers who benefit from purchases by the copper industry is endless. These workers, be they salesmen, clerks, engineers, carpenters, secretaries or plant managers, in turn make purchases of goods and services in their community and, therefore, support insurance agents, grocers, department stores, car dealers, apartment houses, gas stations, hobby shops, and infinitum.

Arizona's copper mining industry is not only an important source of copper production and employment opportunity, it is an important source of tax revenues for support of schools and other government services. In an effort to determine the characteristics of mining, one of the State's oldest industries, on state tax revenues the Arizona Mining Association has prepared a profile entitled, Arizona Mining Taxation Study. This section is a summary of that Study which was published in the Arizona Legislative Review, November 7, 1973, and subsequent data published in the Copper Industry's Contribution to Government Revenues in Arizona, 1973, prepared by the Arizona Economic Information Center.

Under the property tax program, which became effective in 1968-69, mines are assessed at 60% of their full cash value, while agriculture and manufacturing are taxed at 18 and 25% respectively. The table below gives the assessed valuations of the three industries and the table on the following page shows the relative percentages of total state assessed valuation for each of the three industries.

#### Assessed Valuations of Selected Industries

| Fiscal Year | Manufacturing | Agriculture   | Mining        |
|-------------|---------------|---------------|---------------|
| 1970 - 71   | \$108,944,529 | \$135,814,040 | \$427,995,483 |
| 1971 - 72   | 145,632,953   | 135,645,172   | 490,862,883   |
| 1972 - 73   | 163,035,634   | 131,608,245   | 561,222,180   |
| 1973 - 74   | 203,556,513   | 138,081,928   | 557,215,167   |

**Assessed Valuations of Selected Industries  
As a Percent of Total State Assessed Valuations**

| Fiscal Year | Manufacturing | Agriculture | Mining |
|-------------|---------------|-------------|--------|
| 1970 - 71   | 3.77%         | 4.70%       | 14.81% |
| 1971 - 72   | 4.60%         | 4.28%       | 15.50% |
| 1972 - 73   | 4.49%         | 3.62%       | 15.44% |
| 1973 - 74   | 4.56%         | 3.09%       | 12.47% |

The Industry's total tax contribution to Arizona was nearly \$77 million in combined state and local taxes for 1973, 10 percent greater than the copper industry's 1972 tax payments. These taxes include property taxes, severance taxes (excise), corporate income taxes, payroll taxes and miscellaneous taxes such as taxes of goods and services purchased and motor vehicle licenses and fees. This \$77 million in state and local taxes, still, does not include any Federal corporate income taxes.

TABLE I

## COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

| Company<br>Mine                 | 1972                        |                                 |                                     | 1973                        |                                 |                                     |
|---------------------------------|-----------------------------|---------------------------------|-------------------------------------|-----------------------------|---------------------------------|-------------------------------------|
|                                 | Tons<br>Copper Ore<br>Mined | Pounds<br>Recoverable<br>Copper | Pounds<br>Recoverable<br>Molybdenum | Tons<br>Copper Ore<br>Mined | Pounds<br>Recoverable<br>Copper | Pounds<br>Recoverable<br>Molybdenum |
| <b>ANAMAX:</b>                  |                             |                                 |                                     |                             |                                 |                                     |
| Twin Buttes                     | <u>10,137,624</u>           | <u>155,719,980</u>              | <u>2,119,249</u>                    | <u>10,891,871</u>           | <u>123,424,094</u>              | <u>3,239,623</u>                    |
| <b>ASARCO:</b>                  |                             |                                 |                                     |                             |                                 |                                     |
| Silver Bell                     | 3,839,600                   | 39,223,598                      | 128,582                             | 3,866,100                   | 39,436,966                      | -                                   |
| Precipitate Copper              |                             | 7,897,007                       | -                                   | -                           | 8,092,408                       | -                                   |
| Mission                         | 8,363,800                   | 90,742,767                      | 1,902,029                           | 8,782,500                   | 93,116,867                      | 813,742                             |
| San Xavier - Si. flux           | 75,580                      | 1,229,772                       | -                                   | 24,900                      | 401,465                         | -                                   |
| Precipitate Copper 1/           |                             |                                 |                                     | 837,100                     | 4,955,319                       | -                                   |
| Total                           | <u>12,278,980</u>           | <u>139,093,144</u>              | <u>2,030,611</u>                    | <u>13,510,600</u>           | <u>146,003,025</u>              | <u>813,742</u>                      |
| <b>CITIES SERVICE -</b>         |                             |                                 |                                     |                             |                                 |                                     |
| <b>MIAMI COPPER OPERATIONS:</b> |                             |                                 |                                     |                             |                                 |                                     |
| Copper Cities                   | 5,052,617                   | 42,501,763                      | 213,926                             | 5,222,974                   | 41,952,762                      | 262,341                             |
| Copper Cities Precipitate       |                             | 4,577,066                       |                                     |                             | 4,569,813                       |                                     |
| Miami - Precipitate             |                             | 12,170,335                      |                                     |                             | 11,987,674                      |                                     |
| Total                           | <u>5,052,617</u>            | <u>59,249,164</u>               | <u>213,926</u>                      | <u>5,222,974</u>            | <u>58,510,249</u>               | <u>262,341</u>                      |
| <b>CYPRUS MINES:</b>            |                             |                                 |                                     |                             |                                 |                                     |
| Bagdad                          | 1,982,368                   | 24,558,652                      | 455,380                             | 2,088,074                   | 24,036,267                      | 500,022                             |
| Cathode Copper                  |                             | 13,390,668                      |                                     |                             | 14,266,685                      |                                     |
| Pima                            | <u>18,698,023</u>           | <u>165,682,532</u>              | <u>1,158,513</u>                    | <u>20,320,848</u>           | <u>176,280,641</u>              | <u>1,875,621</u>                    |
| Total                           | <u>20,680,391</u>           | <u>203,631,852</u>              | <u>1,613,893</u>                    | <u>22,408,922</u>           | <u>214,583,593</u>              | <u>2,375,643</u>                    |
| <b>DUVAL:</b>                   |                             |                                 |                                     |                             |                                 |                                     |
| Esperanza                       |                             | 194,795                         |                                     | 6,454,040                   | 35,646,020                      | 3,424,619                           |
| Precipitate Copper              |                             | 2,094,329                       |                                     |                             | 2,267,530                       |                                     |
| Mineral Park                    | 6,975,594                   | 44,181,863                      | 3,503,237                           | 6,754,708                   | 40,920,576                      | 3,735,026                           |
| Precipitate Copper              | -                           | 8,935,811                       | -                                   |                             | 6,431,410                       |                                     |
| Sierrita                        | <u>28,304,333</u>           | <u>137,880,330</u>              | <u>11,677,246</u>                   | <u>30,489,595</u>           | <u>151,189,684</u>              | <u>14,297,148</u>                   |
| Total                           | <u>35,279,927</u>           | <u>193,287,128</u>              | <u>15,180,483</u>                   | <u>43,698,343</u>           | <u>236,455,220</u>              | <u>21,456,893</u>                   |
| <b>KENNECOTT:</b>               |                             |                                 |                                     |                             |                                 |                                     |
| Ray                             | 10,364,150                  | 122,736,684                     | 31,538                              | 12,322,927                  | 164,319,931                     | 614,100                             |
| Precipitate Copper              |                             | 31,472,083                      |                                     |                             | 28,369,163                      |                                     |
| Total                           | <u>10,364,150</u>           | <u>154,208,767</u>              | <u>31,538</u>                       | <u>12,322,927</u>           | <u>192,689,094</u>              | <u>614,100</u>                      |

(continued next page)

| TABLE I (continued)                                       |                             |                                 |                                     |                             |                                 |                                     |
|-----------------------------------------------------------|-----------------------------|---------------------------------|-------------------------------------|-----------------------------|---------------------------------|-------------------------------------|
| Company<br>Mine                                           | 1972                        |                                 |                                     | 1973                        |                                 |                                     |
|                                                           | Tons<br>Copper Ore<br>Mined | Pounds<br>Recoverable<br>Copper | Pounds<br>Recoverable<br>Molybdenum | Tons<br>Copper Ore<br>Mined | Pounds<br>Recoverable<br>Copper | Pounds<br>Recoverable<br>Molybdenum |
| INSPIRATION:                                              |                             |                                 |                                     |                             |                                 |                                     |
| Inspiration                                               | 7,792,285                   | 87,407,628                      | 28,138                              | 8,743,989                   | 86,268,188                      | 105,275                             |
| Copper recovered by<br>dump, in-place and<br>vat leaching |                             | 20,587,885                      |                                     |                             | 16,395,179                      |                                     |
| Christmas Division                                        | 1,850,122                   | 22,488,926                      |                                     | 1,938,611                   | 19,016,412                      |                                     |
| Ox Hide Mine                                              | 2,400,230                   | 9,672,768                       |                                     | 1,528,527                   | 8,949,641                       |                                     |
| Total                                                     | 12,042,637                  | 140,157,207                     | 28,138                              | 12,211,127                  | 130,629,420                     | 105,275                             |
| MACMA:                                                    |                             |                                 |                                     |                             |                                 |                                     |
| San Manuel                                                | 21,844,943                  | 271,501,061                     | 4,953,567                           | 21,899,574                  | 279,658,911                     | 5,427,939                           |
| Superior                                                  | 450,573                     | 36,337,188                      |                                     | 542,828                     | 45,781,968                      |                                     |
| Total                                                     | 22,295,516                  | 307,838,249                     | 4,953,567                           | 22,442,402                  | 325,440,879                     | 5,427,939                           |
| PHELPS DODGE:                                             |                             |                                 |                                     |                             |                                 |                                     |
| Morenci                                                   | 17,214,592                  | 215,031,874                     |                                     | 18,360,585                  | 213,400,380                     |                                     |
| Precipitate Copper                                        |                             | 24,492,649                      |                                     |                             | 25,668,461                      |                                     |
| New Cornelia                                              | 9,792,178                   | 115,749,958                     |                                     | 10,343,337                  | 107,589,514                     |                                     |
| Lavender Pit                                              | 3,760,691                   | 33,263,583                      |                                     | 3,770,041                   | 30,242,798                      |                                     |
| Precipitate Copper                                        |                             | 9,999,890                       |                                     |                             | 8,531,891                       |                                     |
| Copper Queen                                              | 643,385                     | 53,798,695                      |                                     | 620,387                     | 45,255,978                      |                                     |
| Precipitate Copper                                        |                             | 2/                              |                                     |                             | 2/                              |                                     |
| Total                                                     | 31,410,846                  | 452,336,649                     |                                     | 33,094,350                  | 430,689,022                     |                                     |
| Total Large Companies                                     | 159,542,668                 | 1,805,522,140                   | 26,171,405 4/                       | 175,803,516                 | 1,858,424,596                   | 34,295,556 4/                       |
| GRAND TOTAL 3/                                            | 165,914,825 5/              | 1,817,224,000                   | 27,216,000 4/                       | 181,218,661                 | 1,854,542,000                   | 37,657,000 4/                       |

Source: Company Reports unless otherwise noted. 1/ San Xavier discontinued production of Siliceous Flux and commenced production of copper precipitates as of May 1, 1973. 2/ Included with Lavender Pit precipitate copper. 3/ U.S. Bureau of Mines (USBM) data: The USBM data includes total Arizona production and, therefore, should, except in the case of recoverable molybdenum (See Footnote 4/) be larger than that production listed under "Total Large Companies". Arizona Department of Mineral Resources estimates of total Arizona copper production as recoverable content of ores and precipitates was 1,836,000,177 pounds in 1972 and 1,891,552,294 in 1973. Differences are due to times and methods of reporting. The USBM total is used throughout this report. 4/ Arizona's entire molybdenum production is a product of the copper mines. Differences in totals are due to time and methods of reporting. 5/ Includes some copper-zinc and lead-zinc ore in addition to copper ore, all of which is combined to avoid disclosing individual company confidential data.



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

| Property               | 1964   | 1965   | 1966   | 1967   | 1968   | 1969   | 1970   | 1971   | 1972   | 1973   |
|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Bagdad <sup>2/</sup>   | 15,507 | 15,833 | 13,024 | 11,066 | 14,258 | 14,781 | 7,281  | 14,681 | 13,391 | 14,267 |
| Bisbee <sup>3/</sup>   | 11,209 | 10,784 | 8,197  | 4,443  | 7,285  | 7,002  | 7,407  | 8,345  | 10,000 | 8,532  |
| Bluebird <sup>4/</sup> | -      | -      | 7,200  | 7,690  | 1,449  | 9,921  | 11,520 | 12,458 | 14,680 | 15,005 |
| Castle Dome            | 4,883  | 4,060  | 4,122  | 2,122  | 2,431  | 1,831  | 934    | -      | -      | -      |
| Copper Cities          | 5,719  | 4,259  | 5,169  | 2,792  | 4,356  | 3,799  | 4,491  | 4,376  | 4,577  | 4,570  |
| Emerald Isle           | -      | -      | -      | 275    | 1,611  | 4,180  | 3,713  | 3,822  | 3,629  | 2,180  |
| Esperanza              | 4,969  | 4,348  | 5,909  | 6,132  | 4,478  | 3,619  | 4,428  | 4,454  | 2,094  | 2,268  |
| Inspiration            | 56,571 | 66,048 | 51,352 | 27,969 | 30,930 | 45,108 | 48,097 | 45,588 | 56,487 | 50,401 |
| Miami                  | 17,757 | 17,906 | 17,168 | 8,726  | 11,077 | 13,756 | 14,965 | 12,806 | 12,170 | 11,988 |
| Mineral Hill           | -      | -      | -      | -      | 4,901  | 2,887  | -      | -      | -      | -      |
| Mineral Park           | -      | 1,484  | 4,837  | 7,005  | 7,051  | 6,221  | 7,710  | 7,315  | 8,936  | 6,431  |
| Morenci                | 1,624  | 1,561  | 24,903 | 27,780 | 23,162 | 22,754 | 16,950 | 14,188 | 24,493 | 25,668 |
| Old Reliable           | -      | -      | -      | -      | -      | -      | -      | -      | -      | 5,992  |
| Ox Hide                | -      | -      | -      | -      | 744    | 7,243  | 13,298 | 7,962  | 9,673  | 8,950  |
| Ray <sup>5/</sup>      | 18,085 | 18,838 | 21,017 | 21,188 | 21,742 | 29,968 | 43,971 | 31,622 | 31,472 | 28,369 |
| Red Hills              | -      | -      | -      | -      | -      | -      | -      | 46     | -      | -      |
| San Xavier             | -      | -      | -      | -      | -      | -      | -      | -      | -      | 4,955  |
| Silver Bell            | 4,854  | 4,580  | 5,066  | 5,017  | 4,909  | 5,226  | 5,614  | 6,297  | 7,897  | 8,092  |
| United Verde           | -      | -      | 457    | 190    | 307    | 248    | 232    | 165    | 140    | 214    |
| Zonia                  | -      | -      | 1,814  | 3,264  | 3,928  | 3,576  | 4,456  | 4,769  | 4,778  | 2,991  |

- <sup>1/</sup> Copper recovered from precipitate and/or by solvent extraction from material dump, heap, vat or in situ leached.  
<sup>2/</sup> Precipitation replaced by solvent extraction in 1971  
<sup>3/</sup> Lavender Pit and Copper Queen  
<sup>4/</sup> Precipitation replaced by solvent extraction in 1969  
<sup>5/</sup> Includes only copper contained in precipitates from dump leaching. Does not include copper produced by electrowinning.

TABLE III

ARIZONA COPPER MINING - OUTPUT OF COPPER ORE; AMOUNT AND VALUE OF  
COPPER, GOLD, SILVER AND MOLYBDENUM RECOVERED THEREFROM 1/

| Year | Copper Ore<br>Tons    | Gold<br>Troy Ounces<br>Value      | Silver<br>Troy Ounces<br>Value                | Molybdenum <u>2/</u><br>Lbs. ) Thou-<br>Value) sands | Copper <u>3/</u><br>Pounds<br>Value | Lbs./Ore Ton<br>Ave./c lb. <u>4/</u> | Value of Copper,<br>Gold, Silver &<br>Molybdenum |
|------|-----------------------|-----------------------------------|-----------------------------------------------|------------------------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------------------|
| 1964 | 86,132,039            | 133,983<br>\$4,689,405            | 4,915,362<br>\$ 6,355,563                     | 6,296<br>\$ 9,532                                    | 1,279,898,700<br>\$ 409,055,625     | 14.9<br>31.960                       | \$ 429,632,593                                   |
| 1965 | 92,859,535            | 133,830<br>\$4,684,050            | 5,352,850<br>\$ 6,921,235                     | 9,399<br>\$15,880                                    | 1,309,809,700<br>\$ 458,305,893     | 14.1<br>35.017                       | \$ 485,791,178                                   |
| 1966 | 101,558,298           | 127,431<br>\$4,460,085            | 5,595,644<br>\$ 7,235,168                     | 10,161<br>\$17,812                                   | 1,359,481,200<br>\$ 491,724,350     | 13.39<br>36.170                      | \$ 521,231,603                                   |
| 1967 | 74,239,203            | 66,933<br>\$2,342,655             | 3,996,587<br>\$ 6,193,431                     | 9,261<br>\$15,385                                    | 901,853,500<br>\$ 344,742,519       | 12.14<br>38.226                      | \$ 368,663,605                                   |
| 1968 | 101,293,963           | 89,419<br>\$3,510,600             | 4,697,394<br>\$10,074,000                     | 12,127<br>\$19,207                                   | 1,146,313,600<br>\$ 479,697,900     | 11.32<br>41.847                      | \$ 512,489,500                                   |
| 1969 | 127,848,828           | 108,718 <u>5/</u><br>\$4,586,800  | 5,899,843 <u>5/</u><br>\$10,564,700           | 12,699<br>\$20,947                                   | 1,477,520,000<br>\$ 702,324,400     | 11.56<br>47.534                      | \$ 738,422,900                                   |
| 1970 | 150,240,842           | 107,292 <u>5/</u><br>\$3,904,400  | 7,130,261 <u>5/</u><br>\$12,626,700           | 15,672<br>\$26,700                                   | 1,694,294,000<br>\$ 977,608,000     | 11.28<br>57.700                      | \$1,020,838,800                                  |
| 1971 | 149,293,547           | 93,617 <u>5/</u><br>\$3,820,510   | 6,106,204 <u>5/</u><br>\$ 9,437,749 <u>7/</u> | 22,684<br>\$39,872                                   | 1,529,780,500<br>\$ 786,812,004     | 9.76<br>51.433                       | \$ 830,598,891                                   |
| 1972 | 165,914,825 <u>8/</u> | 102,526 <u>5/</u><br>\$5,987,518  | 6,614,957 <u>5/</u><br>\$11,143,226 <u>7/</u> | 27,216<br>\$46,791                                   | 1,695,858,000<br>\$ 858,392,446     | 10.22<br>50.617                      | \$ 922,314,190                                   |
| 1973 | 181,311,945 <u>8/</u> | 102,376 <u>5/</u><br>\$10,013,397 | 7,164,988 <u>5/</u><br>\$18,325,173 <u>7/</u> | 37,657<br>\$59,372                                   | 1,735,012,000<br>\$1,021,314,814    | 9.57<br>58.865                       | \$1,109,025,384                                  |

1/ U.S. Bureau of Mines. 2/ Molybdenum content of recovered concentrate. 3/ Does not include precipitate copper from dump and in-place leaching. 4/ E/MJ average prices, domestic, f.o.b. refinery. 5/ Does not include gold or silver recovered from vat or heap leaching of copper ores. 6/ At average gold prices; See note 7/, Table XV 7/ At average E/MJ N.Y. market price for .999 fine silver. 8/ Includes some copper-zinc and lead-zinc ore in addition to copper ore, all of which is combined to avoid disclosing individual company confidential data.

TABLE IV

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

1858 - 1973 Inclusive - In terms of Recoverable Metals

|                   | COPPER     |                      | LEAD       |                      | ZINC       |                      |
|-------------------|------------|----------------------|------------|----------------------|------------|----------------------|
|                   | Short Tons | Value<br>(thousands) | Short Tons | Value<br>(thousands) | Short Tons | Value<br>(thousands) |
| 1858 - 1972       | 25,799,363 | 13,875,086           | 654,429    | 129,949              | 1,057,324  | 260,828              |
| 1973              | 927,271    | 1,103,453            | 763        | 248                  | 8,427      | 3,482                |
| Total 1858 - 1973 | 26,726,634 | 14,978,539           | 655,192    | 130,197              | 1,065,751  | 264,310              |

  

|                   | GOLD       |                      | SILVER      |                      | COPPER, LEAD, ZINC,<br>GOLD AND SILVER |
|-------------------|------------|----------------------|-------------|----------------------|----------------------------------------|
|                   | Ounces     | Value<br>(thousands) | Ounces      | Value<br>(thousands) | Combined Value                         |
| 1858 - 1972       | 14,058,177 | 383,835              | 429,345,226 | 461,149              | 15,031,716,000                         |
| 1973              | 102,838    | 10,060               | 7,199,000   | 18,416               | 1,135,659,000                          |
| Total 1858 - 1973 | 14,161,025 | 393,895              | 436,544,226 | 479,565              | 16,167,375,000                         |

  

|                                                                        |                |
|------------------------------------------------------------------------|----------------|
| Est. Value of Other Metals & Non-Metallics Produced through 1972       | 1,306,344,000  |
| Value of Other Metals & Non-Metallics Produced in 1973                 | 169,329,000    |
| Est. Value of Other Metals & Non-Metallics Produced through 1973       | 1,475,673,000  |
| Grand Total Estimated Value of Arizona Mineral Production through 1973 | 17,643,048,000 |

Source: U.S. Bureau of Mines; U.S. Geological Survey; Arizona Bureau of Mines

TABLE V

## MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD AND ZINC IN ARIZONA IN 1973, BY CLASSES OF ORE OR OTHER SOURCE MATERIALS, IN TERMS OF RECOVERABLE METALS

| <u>Source</u>        | <u>Number<br/>of<br/>mines 1/</u> | <u>Material sold<br/>or treated<br/>(short tons)</u> | <u>Gold<br/>(troy<br/>ounces)</u> | <u>Silver<br/>(troy<br/>ounces)</u> | <u>Copper<br/>(short<br/>tons)</u> | <u>Lead<br/>(short<br/>tons)</u> | <u>Zinc<br/>(short<br/>tons)</u> |
|----------------------|-----------------------------------|------------------------------------------------------|-----------------------------------|-------------------------------------|------------------------------------|----------------------------------|----------------------------------|
| Lode ore:            |                                   |                                                      |                                   |                                     |                                    |                                  |                                  |
| Gold                 | 3                                 | 20,755                                               | 51                                | 497                                 | 88                                 | --                               | --                               |
| Gold-silver          | 2                                 | 79,735                                               | 409                               | 30,268                              | 101                                | --                               | --                               |
| Silver               | 2                                 | 12,273                                               | --                                | 3,419                               | (2/)                               | --                               | --                               |
| Total                | 7                                 | 112,763                                              | 460                               | 34,184                              | 189                                | --                               | --                               |
| Copper               | 27                                | 181,218,661                                          | 101,923                           | 7,130,066                           | 864,289                            | 571                              | 20                               |
| Copper-zinc          | 1                                 | 93,284                                               | 453                               | 34,922                              | 3,217                              | 192                              | 8,407                            |
| Total                | 28                                | 181,311,945                                          | 102,376                           | 7,164,988                           | 867,506                            | 763                              | 8,427                            |
| Other lode material: |                                   |                                                      |                                   |                                     |                                    |                                  |                                  |
| Copper Cleanup       | (3/)                              | 857                                                  | 6                                 | 79                                  | 47                                 | --                               | --                               |
| Copper precipitates  | 15                                | 80,511                                               | --                                | --                                  | 59,529                             | --                               | --                               |
| Total                | 15                                | 81,368                                               | 6                                 | 79                                  | 59,576                             | --                               | --                               |
| Placer               | 1                                 | --                                                   | 6                                 | --                                  | --                                 | --                               | --                               |
| Grand total          | 41                                | 181,506,076                                          | 102,848                           | 7,199,251                           | 927,271                            | 763                              | 8,427                            |

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

2/ Less than  $\frac{1}{2}$  unit.

3/ From properties not classed as mines.



TABLE VI  
Mineral production in Arizona 1/

| Mineral                                                                                                                                                                                                               | 1972     |                      | 1973     |                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------|----------|----------------------|
|                                                                                                                                                                                                                       | Quantity | Value<br>(thousands) | Quantity | Value<br>(thousands) |
| Clays 2/-----thousand short tons                                                                                                                                                                                      | 134      | \$355                | 117      | \$459                |
| Coal (bituminous)-----do-----                                                                                                                                                                                         | W        | W                    | 3,246    | W                    |
| Copper (recoverable content of ores, etc.)<br>short tons                                                                                                                                                              | 908,612  | 930,419              | 927,271  | 1,103,453            |
| Gem stones-----                                                                                                                                                                                                       | NA       | 168                  | NA       | 170                  |
| Gold (recoverable content of ores, etc.)<br>troy ounces                                                                                                                                                               | 102,996  | 6,036                | 102,848  | 10,060               |
| Gypsum-----thousand short tons                                                                                                                                                                                        | W        | W                    | 158      | 669                  |
| Lead (recoverable content of ores, etc.)<br>short tons                                                                                                                                                                | 1,763    | 530                  | 763      | 248                  |
| Lime-----thousand short tons                                                                                                                                                                                          | 356      | 6,024                | 365      | 7,019                |
| Molybdenum (W content)-----thousand pounds                                                                                                                                                                            | 27,216   | 46,791               | 37,657   | 59,372               |
| Natural gas-----million cubic feet                                                                                                                                                                                    | 442      | 80                   | 125      | 23                   |
| Petroleum (crude)-thousand 42 gallon barrels                                                                                                                                                                          | 993      | 3,226                | 804      | 3,103                |
| Pumice-----thousand short tons                                                                                                                                                                                        | 915      | 722                  | 853      | 715                  |
| Sand and gravel-----do-----                                                                                                                                                                                           | 24,842   | 32,420               | 27,440   | 38,503               |
| Silver (recoverable content of ores, etc.)<br>troy ounces                                                                                                                                                             | 6,653    | 11,210               | 7,199    | 18,416               |
| Stone-----thousand short tons                                                                                                                                                                                         | 4,638    | 8,018                | 4,265    | 9,469                |
| Zinc (recoverable content of ores, etc.)<br>short tons                                                                                                                                                                | 10,111   | 3,589                | 8,427    | 3,482                |
| Value of items that cannot be disclosed:<br>Asbestos, cement, fire clay, diatomite<br>(1972), feldspar, fluorspar, helium, iron<br>ore, mica (scrap), perlite, pyrites,<br>tungsten, and values indicated by symbol W | XX       | 41,416               | XX       | 49,827               |
| Total-----                                                                                                                                                                                                            | XX       | 1,091,004            | XX       | 1,304,988            |
| Total 1967 constant dollars-----                                                                                                                                                                                      | XX       | 900,187              | XX       | p/ 958,122           |

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

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Excludes fire clay; included with "Value of items that cannot be disclosed."

TABLE VII

## ARIZONA INDUSTRIES COVERED BY SOCIAL SECURITY

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

AND AVERAGE WEEKLY WAGE

Years 1971, 1972 and 1973

| <u>Industry</u>                    | <u>Average<br/>No. of 1/<br/>Employees</u> | <u>Total<br/>Wages</u> | <u>Average<br/>Annual<br/>Wage</u> | <u>Average<br/>Weekly<br/>Wage</u> |
|------------------------------------|--------------------------------------------|------------------------|------------------------------------|------------------------------------|
| <u>YEAR 1971</u>                   |                                            |                        |                                    |                                    |
| Copper Mining <u>2/</u>            | 19,209                                     | \$ 192,278,918         | \$10,010                           | \$192.50                           |
| Copper Smelting <u>3/</u>          | <u>2,022</u>                               | <u>19,699,679</u>      | <u>9,742</u>                       | <u>187.35</u>                      |
| Total Copper Mng. & Smelting       | 21,231                                     | \$ 211,978,597         | 9,984                              | \$192.00                           |
| Other Mining & Quarrying           | <u>1,783</u>                               | <u>17,574,490</u>      | <u>9,857</u>                       | <u>189.56</u>                      |
| All Mng., Quarry'g & Smelting      | 23,014                                     | \$ 229,553,087         | 9,974                              | \$191.81                           |
| Mfg., Ex. Copper Smelting          | 86,398                                     | 767,838,982            | 8,887                              | 170.90                             |
| Construction                       | 43,783                                     | 478,564,486            | 10,930                             | 210.19                             |
| Transp., Utilities, etc. <u>4/</u> | 28,651                                     | 265,094,029            | 9,252                              | 177.92                             |
| Wholesale - Retail Trade           | 130,669                                    | 766,582,732            | 5,866                              | 112.81                             |
| Services, Finance and Misc.        | <u>99,957</u>                              | <u>657,528,823</u>     | <u>6,578</u>                       | <u>126.50</u>                      |
| TOTALS AND AVERAGES                | 412,472                                    | \$3,165,162,139        | \$ 7,674                           | \$147.58                           |
| <u>YEAR 1972</u>                   |                                            |                        |                                    |                                    |
| Copper Mining <u>2/</u>            | 20,892                                     | \$ 229,345,846         | \$10,978                           | \$211.12                           |
| Copper Smelting <u>3/</u>          | <u>2,341</u>                               | <u>25,371,495</u>      | <u>10,838</u>                      | <u>208.42</u>                      |
| Total Copper Mng. & Smelting       | 23,233                                     | \$ 254,717,341         | \$10,964                           | \$210.85                           |
| Other Mng., Quarry'g & Smelting    | <u>1,847</u>                               | <u>19,938,264</u>      | <u>10,795</u>                      | <u>207.60</u>                      |
| All Mng., Quarry'g & Smelting      | 25,080                                     | \$ 274,655,605         | \$10,951                           | \$210.59                           |
| Mfg., Ex. Copper Smelting          | 96,910                                     | 888,392,860            | 9,167                              | 176.28                             |
| Construction                       | 56,033                                     | 630,709,787            | 11,256                             | 216.46                             |
| Transp., Utilities, etc. <u>4/</u> | 30,465                                     | 307,868,725            | 10,106                             | 194.35                             |
| Wholesale - Retail Trade           | 150,437                                    | 919,886,942            | 6,115                              | 117.60                             |
| Services, Finance and Misc.        | <u>167,654</u>                             | <u>1,145,753,218</u>   | <u>6,834</u>                       | <u>131.42</u>                      |
| TOTALS AND AVERAGES                | 526,579                                    | \$4,167,267,137        | \$ 7,914                           | \$152.19                           |

(continued next page)

TABLE VII (continued)

| <u>Industry</u>                 | <u>Average<br/>No. of 1/<br/>Employees</u> | <u>Total<br/>Wages</u> | <u>Average<br/>Annual<br/>Wage</u> | <u>Average<br/>Weekly<br/>Wage</u> |
|---------------------------------|--------------------------------------------|------------------------|------------------------------------|------------------------------------|
| <u>YEAR 1973</u>                |                                            |                        |                                    |                                    |
| Copper Mining 2/                | 22,738                                     | \$ 259,992,642         | \$11,434                           | \$219.89                           |
| Copper Smelting 3/              | 2,756                                      | 31,301,686             | 11,358                             | 218.42                             |
| Total Copper Mng. & Smelting    | 25,494                                     | \$ 291,294,328         | \$11,426                           | \$218.73                           |
| Other Mng., Quarry'g & Smelting | 2,088                                      | 24,415,959             | 11,693                             | 224.87                             |
| All Mng., Quarry'g & Smelting   | 27,582                                     | \$ 315,710,287         | \$11,446                           | \$220.12                           |
| Mfg., Ex. Copper Smelting       | 107,022                                    | 1,034,697,762          | 9,668                              | 185.92                             |
| Construction                    | 64,476                                     | 764,769,342            | 11,861                             | 228.10                             |
| Transp., Utilities, etc. 4/     | 33,901                                     | 364,788,070            | 10,760                             | 206.93                             |
| Wholesale - Retail Trade        | 166,517                                    | 1,073,728,923          | 6,448                              | 124.00                             |
| Services, Finance and Misc.     | 185,090                                    | 1,328,368,192          | 7,177                              | 138.02                             |
| TOTALS AND AVERAGES             | 584,588                                    | \$4,882,062,576        | \$ 8,351                           | \$160.60                           |

Source: Arizona Employment Security Commission.

- 1/ Includes all covered employees. Figures relating to copper mining and smelting, and manufacturing, are adjusted as described in the following footnotes.
- 2/ The first number includes all covered employees in copper mining and milling and probably those in one smelter. The figure, therefore, is higher than that for "All Employees" in "Copper Mining" in Arizona in column 1, Table VIII.
- 3/ According to correspondence from the Employment Security Commission of Arizona, these figures include all covered smelter employees excepting those included in "Copper Mining." A majority of copper smelting employees customarily are reported under "Manufacturing" and the rest under "Copper Mining."
- 4/ Transportation exclusive of railroads.

TABLE VIII

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

| Copper Mining  | Average No. Covered Employees <u>1/</u> | Total Wages <u>2/</u> | Average Annual Wage | Average Weekly Wage | Tons Copper Ores <u>3/</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                 |
| 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              | 165,915,825 <u>4/</u>      |
| 1973           | 25,494                                  | 291,294,328           | 11,426              | 218.89              | 181,311,945                |

1/ "Covered Employment" by law includes all employees of employers of three or more persons. Therefore, the figures for "All Employees" in Table IX should be somewhat higher than those for "Covered Employees" in this table provided the same industries were involved. However, this table includes some smelter workers which the other does not. Prior to 1966 the average numbers in this table included roughly 500 to 1000 Arizona copper smelter workers, the rest of the smelter employees being included under "Manufacturing." Beginning in 1966, all covered smelter workers are included in the average in this column. Figures are from the Unemployment Compensation Division, Employment Security Commission of Arizona.

2/ "Total Wages in Covered Industry," "Mining-copper."

3/ Short tons of "Lode ore: copper" reported by the U.S. Bureau of Mines.

4/ Includes some copper-zinc and lead-zinc ore in addition to copper ore, all of which is combined to avoid disclosing individual company confidential data.

TABLE IX  
SALIENT COPPER STATISTICS 1/

|                                                     | In short tons       |                     |           |
|-----------------------------------------------------|---------------------|---------------------|-----------|
|                                                     | 1971                | 1972                | 1973      |
| <u>Mine Production</u>                              |                     |                     |           |
| Arizona                                             | 820,171             | 908,612             | 927,271   |
| United States                                       | 1,522,183           | 1,664,840           | 1,717,940 |
| World                                               | 6,688,634 <u>r/</u> | 7,324,378 <u>r/</u> | 7,856,681 |
| <u>Primary Refined Stocks at U.S. Refineries a/</u> |                     |                     |           |
| Beginning of Year                                   | 130,000             | 75,000              | 57,000    |
| End of Year                                         | 75,000              | 57,000              | 37,000    |
| <u>Primary Refined Prod. of U.S. Refineries</u>     |                     |                     |           |
| From Domestic Ores                                  | 1,410,523           | 1,680,412           | 1,698,337 |
| From Foreign Ores, Matte, etc. <u>a/</u>            | 181,259             | 192,821             | 170,151   |
| Total                                               | 1,591,782           | 1,873,233           | 1,868,488 |
| <u>Secondary Copper Produced from Scrap</u>         |                     |                     |           |
| Recovered as Unalloyed Copper                       | 429,095             | 447,409 <u>r/</u>   | 484,623   |
| Recovered in Alloys <u>b/</u>                       | 771,025             | 853,564 <u>r/</u>   | 827,682   |
| Total Secondary Copper                              | 1,200,120           | 1,300,973           | 1,312,305 |
| <u>Imports:</u>                                     |                     |                     |           |
| Copper in Ores, Concentrates, Matte                 | 31,288              | 55,013              | 42,881    |
| Copper in Blister                                   | 156,744             | 157,432             | 154,104   |
| Refined Copper <u>a/</u>                            | 163,988             | 192,379             | 201,513   |
| Total Imports                                       | 352,020             | 404,824             | 398,498   |
| <u>Exports:</u>                                     |                     |                     |           |
| Copper in Ores, Concs., Matte, Blister              | 36,824              | 26,181              | 30,870    |
| Refined Copper <u>a/</u>                            | 187,654             | 182,743             | 189,396   |
| Total Exports                                       | 224,478             | 208,924             | 220,266   |
| <u>Excess of Imports Over Exports</u>               | 127,542             | 195,900             | 178,232   |
| <u>Consumption:</u>                                 |                     |                     |           |
| New Refined (Apparent Consumption)                  | 1,623,000           | 1,901,000           | 1,730,000 |
| Total Refined (Actual Consumption)                  | 2,019,507           | 2,238,867           | 2,437,048 |
| <u>U.S. Mine Production</u>                         |                     |                     |           |
| Percent of Apparent Consumption                     | 93.8                | 87.6                | 99.3      |
| <u>Average Price of Copper c/</u>                   | 51.43¢              | 50.62¢              | 58.86¢    |

r/ Revised

1/ U.S. Bureau of Mines; American Bureau Metal Statistics

a/ May include some from scrap

b/ Includes copper in chemicals: 1971-3,206; 1972-3,036; 1973-3,704

c/ "Electrolytic copper, domestic refineries, on Atlantic Seaboard." Source: E/MJ



TABLE X

MINE PRODUCTION OF RECOVERABLE COPPER IN THE UNITED STATES 1/

(In short tons)

| <u>STATE</u>           | <u>1971</u>      | <u>1972</u>      | <u>1973</u>      | RANK<br>IN<br><u>1972</u> |
|------------------------|------------------|------------------|------------------|---------------------------|
| Arizona                | 820,171          | 908,612          | 927,271          | 1                         |
| California             | 515              | 598              | 369              | 13                        |
| Colorado               | 3,938            | 3,944            | 3,123            | 10                        |
| Idaho                  | 3,776            | 2,942            | 3,625            | 9                         |
| Maine                  | 2,510            | 1,220            | 1,107            | 12                        |
| Michigan               | 56,005           | 67,260           | 72,221           | 6                         |
| Missouri               | 8,445            | 11,509           | 10,273           | 7                         |
| Montana                | 88,581           | 123,110          | 132,465          | 4                         |
| Nevada                 | 96,928           | 101,119          | 93,702           | 5                         |
| New Mexico             | 157,419          | 168,034          | 204,742          | 3                         |
| Pennsylvania           | 3,349            | 2,611            | 1,845            | 11                        |
| Tennessee              | 13,916           | 11,310           | 8,500            | 8                         |
| Utah                   | 263,451          | 259,507          | 256,589          | 2                         |
| Other States <u>2/</u> | 3,179            | 3,064            | 2,107            |                           |
| TOTALS                 | <u>1,522,183</u> | <u>1,664,840</u> | <u>1,717,940</u> |                           |

1/ Source: U.S. Bureau of Mines2/ Includes: Alaska, Oklahoma, Oregon, Washington and Wyoming

TABLE XI

WORLD MINE PRODUCTION OF COPPER BY COUNTRIES 1/  
(Short tons)

| <u>Country</u>                    | <u>1971</u>       | <u>1972</u>       | <u>1973 p/</u>   |
|-----------------------------------|-------------------|-------------------|------------------|
| <b>North and Central America:</b> |                   |                   |                  |
| Canada <u>2/</u>                  | 721,429           | 793,303           | 899,474          |
| Cuba <u>e/</u>                    | 3,300             | 3,300             | 5,500            |
| Dominican Republic <u>e/</u>      | 500               | 500               | 500              |
| Haiti <u>3/</u>                   | 7,300             | (4/)              | --               |
| Mexico                            | 69,611            | 86,774            | 88,737           |
| Nicaragua <u>3/</u>               | 4,037             | 2,412             | 1,703            |
| United States <u>2/</u>           | 1,522,183         | 1,664,840         | 1,717,940        |
| <b>South America:</b>             |                   |                   |                  |
| Argentina                         | <u>r/</u> 557     | 1,250             | <u>e/</u> 1,300  |
| Bolivia <u>5/</u>                 | 8,281             | 9,324             | <u>e/</u> 9,500  |
| Brazil                            | <u>6/</u> 5,622   | 4,745             | 6,711            |
| Chile                             | 790,722           | 799,968           | 818,804          |
| Colombia                          | 62                | 71                | <u>e/</u> 80     |
| Ecuador                           | 622               | 483               | 530              |
| Peru                              | <u>r/</u> 228,560 | 248,031           | 241,156          |
| <b>Europe:</b>                    |                   |                   |                  |
| Albania <u>7/</u>                 | 6,504             | <u>r/e/</u> 6,970 | <u>e/</u> 7,100  |
| Austria                           | 2,920             | 2,539             | 3,023            |
| Bulgaria                          | <u>r/</u> 38,600  | 41,900            | <u>e/</u> 44,100 |
| Czechoslovakia                    | <u>r/</u> 5,180   | 5,180             | 6,600            |
| Finland                           | 31,317            | 32,121            | 41,192           |
| France                            | <u>r/</u> 368     | 520               | 456              |
| Germany, East <u>e/</u>           | <u>r/</u> 5,500   | <u>r/</u> 3,300   | 1,700            |
| Germany, West <u>8/</u>           | <u>r/</u> 1,636   | 1,456             | 1,583            |
| Greece                            | 1,577             | 1,715             | 1,587            |
| Hungary <u>e/</u>                 | 1,300             | 1,300             | 1,400            |
| Ireland                           | <u>r/</u> 13,104  | 14,560            | 14,336           |
| Italy <u>3/</u>                   | 1,698             | 1,156             | 1,000            |
| Norway <u>8/</u>                  | 23,889            | 27,971            | 31,320           |
| Poland                            | 134,700           | 148,800           | 170,900          |
| Portugal <u>8/</u>                | 4,362             | 6,744             | 6,409            |
| Romania <u>e/2/</u>               | 15,700            | 38,600            | 46,300           |
| Spain <u>8/9/</u>                 | 37,514            | 39,812            | 33,370           |
| Sweden                            | 33,313            | 33,752            | 35,712           |
| U. S. S. R. <u>e/2/7/</u>         | 680,000           | 733,000           | 772,000          |
| Yugoslavia                        | 104,049           | 113,685           | 162,857          |
| <b>Africa:</b>                    |                   |                   |                  |
| Algeria                           | 567               | 472               | 441              |
| Congo (Brazzaville) <u>3/</u>     | <u>r/</u> 1,816   | 1,511             | <u>e/</u> 1,500  |
| Kenya                             | 80                | 79                | <u>e/</u> 70     |
| Mauritania                        | 4,960             | 16,342            | 23,454           |
| Morocco <u>3/</u>                 | <u>r/</u> 4,234   | 4,220             | 4,762            |
| Mozambique <u>3/</u>              | 456               | 198               | 265              |
| Rhodesia, Southern <u>10/</u>     | 32,338            | 42,218            | 46,100           |
| South Africa, Republic of         | 173,581           | 178,494           | 193,783          |

TABLE XI (continued)

WORLD MINE PRODUCTION OF COPPER BY COUNTRIES 1/  
(Short tons)

| <u>Country</u>                               | <u>1971</u>         | <u>1972</u>     | <u>1973 p/</u>   |
|----------------------------------------------|---------------------|-----------------|------------------|
| Africa (continued):                          |                     |                 |                  |
| South-West Africa, Territory of <u>3/11/</u> | 35,317              | 23,830          | 30,282           |
| Uganda                                       | <u>r/</u> 17,906    | 17,346          | 17,286           |
| Zaire                                        | 447,349             | 472,008         | 538,312          |
| Zambia                                       | <u>r/</u> 718,040   | 791,128         | 778,864          |
| Asia:                                        |                     |                 |                  |
| Burma <u>12/</u>                             | 88                  | 88              | 77               |
| China, People's Republic of <u>e/</u>        | 110,000             | 110,000         | 110,000          |
| Cyprus <u>8/</u>                             | <u>r/</u> 21,491    | 20,884          | 16,799           |
| India                                        | 11,867              | 12,856          | 16,085           |
| Indonesia                                    | --                  | 5,500           | 41,800           |
| Iran <u>13/</u>                              | 1,106               | 1,323           | 3,300            |
| Israel                                       | 11,161              | 12,318          | 11,202           |
| Japan <u>14/</u>                             | 133,411             | 123,584         | 100,619          |
| Korea, Republic of                           | 1,955               | 2,295           | 2,558            |
| Korea, North <u>e/</u>                       | 14,000              | 14,000          | 14,000           |
| Malaysia <u>e/</u>                           | <u>r/</u> 230       | 65              | 55               |
| Philippines                                  | 217,787             | 235,558         | 243,825          |
| Taiwan <u>e/</u>                             | <u>r/</u> 2,650     | <u>r/</u> 2,760 | 2,650            |
| Turkey                                       | 24,736              | 27,514          | <u>e/</u> 41,300 |
| Oceania:                                     |                     |                 |                  |
| Australia                                    | <u>r/</u> 195,397   | 205,925         | 240,800          |
| Fiji                                         | --                  | 3               | --               |
| New Zealand                                  | 94                  | 136             | <u>e/</u> 110    |
| Papua New Guinea                             | --                  | 136,641         | 201,502          |
| Total                                        | <u>r/</u> 6,688,634 | 7,329,378       | 7,856,681        |

e/ Estimate. p/ Preliminary. r/ Revised.

1/ Data presented represents copper content (recoverable where indicated) of ore mined wherever possible. If such data are 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 are available has been used.

2/ Recoverable. 3/ Copper content of concentrate produced. 4/ Revised to zero.

5/ Corporacion Minera de Bolivia (COMIBOL) production plus exports by medium and small mines.

6/ Partly estimated, partly calculated on the basis of data furnished by Companhia Brasileira de Cobre.

7/ Smelter production. 8/ Includes copper content of cupriferous pyrites.

9/ Excludes an unreported quantity of copper in iron pyrites which may or may not be recovered. 10/ Year ending September 30 of that stated.

11/ Data are compiled from operating company reports of Tsumeb Corp. Ltd. and General Mining and Finance Corp. Ltd. for Klein Aub Loper Maatskappy Ltd.'s mine near Rehoboth. Data for 1971 are for fiscal year ending June 30, 1971; data for 1972 are a summation of company figures for calendar year 1972 for Tsumeb Corp. Ltd. and for fiscal year ending June 30, 1972, for General Mining and Finance Corp.; data for 1973 are a summation of company figures for calendar year 1973 for Tsumeb Corp. Ltd. and for fiscal year ending June 30, 1973, for General Mining and Finance Corp. Output of Tsumeb Corp. Ltd. for the period July 1, 1971, through December 31, 1971, was 12,813 short tons. 12/ Copper content of matte produced. 13/ Year beginning March 21 of that stated. 14/ Copper content of concentrate. Copper content of run of mine production was as follows in short tons: 1971-133,411; 1972-125,248; 1973-103,871.

TABLE XII

## MINE PRODUCTION OF COPPER IN

## ARIZONA, THE UNITED STATES AND THE WORLD

DOMESTIC PRICE OF COPPER a/

1874 - 1973

| Period         | ARIZONA       |                       |                        | UNITED STATES       |                        |                          | WORLD         |
|----------------|---------------|-----------------------|------------------------|---------------------|------------------------|--------------------------|---------------|
|                | Short<br>Tons | % of<br>U.S.<br>Prod. | % of<br>World<br>Prod. | Short<br>Tons       | % of<br>World<br>Prod. | Price-<br>c Per<br>Pound | Short<br>Tons |
| 1874-          |               |                       |                        |                     |                        |                          |               |
| 1911           | 1,758,000     | 22.0                  | 9.3                    | 7,989,735 <u>b/</u> | 49.1                   | 14.40 <u>c/</u>          | 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 <u>1/</u> | 196,509       | 34.2                  | 19.0                   | 574,216             | 55.5                   | 13.602                   | 1,034,487     |
| 1915 <u>1/</u> | 229,986       | 30.9                  | 19.6                   | 744,036             | 63.4                   | 17.275                   | 1,173,150     |
| 1916 <u>1/</u> | 360,917       | 36.0                  | 23.2                   | 1,002,938           | 64.6                   | 27.202                   | 1,553,498     |
| 1917 <u>1/</u> | 356,083       | 37.6                  | 22.2                   | 947,717             | 59.1                   | 27.180                   | 1,602,914     |
| 1918 <u>1/</u> | 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 <u>2/</u> | 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     |
| 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     |

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 1932-1969); Ariz. Bur. Mines Bull. 140 (1936).

a/ Annual average prices as reported by E/MJ.

b/ Smelter production from domestic ores.

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

1/, 2/, 3/ See page 40

(continued next page)

TABLE XII (continued)

| Period          | ARIZONA       |                       |                        | UNITED STATES |                        |                          | WORLD         |
|-----------------|---------------|-----------------------|------------------------|---------------|------------------------|--------------------------|---------------|
|                 | Short<br>Tons | % of<br>U.S.<br>Prod. | % of<br>World<br>Prod. | Short<br>Tons | % of<br>World<br>Prod. | Price-<br>¢ Per<br>Pound | Short<br>Tons |
| 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                   | 841,998       | 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     |
| 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     |

3/, 4/, 5/, 6/, 7/, 8/, 9/, 10/ see page 40.

(continued next page)



TABLE XII (continued)

| Period          | ARIZONA           |                       |                        | UNITED STATES     |                        |                          | WORLD               |
|-----------------|-------------------|-----------------------|------------------------|-------------------|------------------------|--------------------------|---------------------|
|                 | Short<br>Tons     | % of<br>U.S.<br>Prod. | % of<br>World<br>Prod. | Short<br>Tons     | % of<br>World<br>Prod. | Price-<br>c Per<br>Pound |                     |
| 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           |
| 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 <u>r/</u> |
| 1972            | 908,612           | 55.2                  | 12.4                   | 1,644,840         | 22.5                   | 50.617                   | 7,324,378 <u>r/</u> |
| 1973            | 927,271           | 54.0                  | 11.8                   | 1,717,940         | 21.9                   | 58.865                   | 7,856,681           |
| 1874-<br>1973   | <u>26,725,054</u> | <u>41.9</u>           | <u>13.2</u>            | <u>63,727,963</u> | <u>31.6</u>            |                          | <u>201,739,735</u>  |

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 16½ cents. Many mines were forced to close. Production dropped to 56,000 tons 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.

TABLE XIII

## UNITED STATES PRODUCTION AND CONSUMPTION OF COPPER

In Short Tons

| <u>Year</u> | <u>Mine 1/</u> | <u>Production<br/>Secondary 2/</u> | <u>Total</u>     | <u>Consumption<br/>Total 3/</u> | <u>Total<br/>Production<br/>As % of<br/>Consumption</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        | <u>824,846</u> | <u>261,588</u>                     | <u>1,086,434</u> | <u>1,463,031</u>                | <u>74.3</u>                                             |
| 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                                                    |
| 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      | 446,774                            | 2,111,614        | 2,238,867                       | 94.3                                                    |
| 1973        | 1,717,940      | 482,623                            | 2,200,563        | 2,437,048                       | 90.3                                                    |

Source: U.S. Bureau of Mines.

1/ Recoverable copper.

2/ Copper recovered as unalloyed copper.

3/ Refined copper in cathodes, wire bars, etc.; reported by consumers.

TABLE XIV

## IMPORTS OF PRIMARY COPPER INTO THE UNITED STATES

| Source                                         | Copper Content (short tons) |                |                |
|------------------------------------------------|-----------------------------|----------------|----------------|
|                                                | 1971                        | 1972           | 1973           |
| <u>Ore, Concentrates, Matte</u>                |                             |                |                |
| Canada                                         | 7,325                       | 12,118         | 11,583         |
| Chile                                          | -                           | 71             | 1,654          |
| Mexico                                         | 4                           | 8              | 1,113          |
| Peru                                           | 8,999                       | 9,486          | 8,697          |
| Philippines                                    | 13,616                      | 30,122         | 17,842         |
| Australia                                      | 1,243                       | 2,091          | 1,531          |
| Other Countries                                | 101                         | 1,117          | 461            |
| Total ore, etc.                                | <u>31,238</u>               | <u>55,013</u>  | <u>42,881</u>  |
| <u>Blister Copper</u>                          |                             |                |                |
| Mexico                                         | 4,926                       | 9,544          | 8,799          |
| Chile                                          | 40,594                      | 33,208         | 29,617         |
| Peru                                           | 89,901                      | 81,559         | 86,896         |
| South Africa, Republic of                      | 21,247                      | 23,053         | 26,279         |
| Other Countries                                | 76                          | 10,068         | 2,513          |
| Total Blister                                  | <u>156,744</u>              | <u>157,432</u> | <u>154,104</u> |
| <u>Refined Cathodes and Shapes</u>             |                             |                |                |
| Canada                                         | 123,028                     | 124,983        | 130,523        |
| Chile                                          | 11,057                      | 26,598         | 27,492         |
| West Germany                                   | 4,387                       | 1              | 8,627          |
| Japan                                          | (a)                         | 1,125          | 22             |
| Peru                                           | 3,510                       | 2,204          | 4,384          |
| United Kingdom                                 | 5,513                       | 3,938          | 7,698          |
| Zambia                                         | 6,668                       | -              | 5,455          |
| Other Countries                                | 9,825                       | 33,530         | 17,312         |
| Total Refined                                  | <u>163,988</u>              | <u>192,379</u> | <u>201,513</u> |
| Total Primary Copper Imports                   | 352,020                     | 404,824        | 398,498        |
| Less: Primary Copper Exports                   | 224,478                     | 208,924        | 220,266        |
| (Ore, conct's., matte,<br>blister and refined) |                             |                |                |
| <u>Net Primary Imports</u>                     | <u>127,542</u>              | <u>195,900</u> | <u>178,232</u> |
|                                                | <u>1968</u>                 | <u>1969</u>    | <u>1970</u>    |
| Primary Copper Imports                         | 698,555                     | 408,168        | 390,400        |
| Less: Primary Copper Exports                   | 321,484                     | 205,786        | 290,554        |
| <u>Net Primary Imports</u>                     | <u>377,071</u>              | <u>202,382</u> | <u>99,846</u>  |

Source: U.S. Bureau of Mines  
(a) Not listed separately

TABLE XV

UNITED STATES COPPER MINING - OUTPUT OF COPPER ORE; AMOUNT AND VALUE OF  
COPPER, GOLD AND SILVER RECOVERED THEREFROM 1/

| Year | Copper Ore<br>Tons | Gold<br>Troy Ounces<br>Value                | Silver<br>Troy Ounces<br>Value <u>8/</u>                 | Copper <u>2/</u><br>Pounds<br>Value | Lbs./Ore Ton<br>Ave. <u>3/</u> | Value of<br>Copper, Gold<br>and Silver |
|------|--------------------|---------------------------------------------|----------------------------------------------------------|-------------------------------------|--------------------------------|----------------------------------------|
| 1964 | 155,200,464        | 430,630<br>\$15,072,050                     | 11,470,890<br>\$14,831,861                               | 2,280,880,781<br>\$ 688,734,761     | 14.7<br>31.960                 | \$ 718,638,672                         |
| 1965 | 173,286,198        | 567,531<br>\$19,863,585                     | 12,801,638<br>\$16,552,518                               | 2,430,879,000<br>\$ 851,220,899     | 14.0<br>35.017                 | \$ 887,637,002                         |
| 1966 | 186,966,042        | 547,327<br>\$19,156,445                     | 13,230,411<br>\$17,106,921                               | 2,499,863,100<br>\$ 904,200,483     | 13.37<br>36.170                | \$ 940,463,849                         |
| 1967 | 127,066,097        | 321,398<br>\$11,248,930                     | 8,351,423<br>\$12,942,033                                | 1,608,078,200<br>\$ 614,703,973     | 12.66<br>38.226 <u>4/</u>      | \$ 638,894,936                         |
| 1968 | 170,054,065        | 405,863<br>\$15,934,200                     | 9,532,341<br><u>7/</u> \$20,443,000 <u>8/</u>            | 2,055,156,700<br>\$ 860,021,400     | 12.09<br>41.847 <u>5/</u>      | \$ 896,398,600                         |
| 1969 | 223,751,510        | 579,297 <u>6/</u><br>\$24,440,500 <u>7/</u> | 13,581,516 <u>6/</u><br><u>7/</u> \$24,320,000 <u>8/</u> | 2,691,376,400<br>\$1,279,318,900    | 12.03<br>47.534                | \$1,328,079,400                        |
| 1970 | 257,729,000        | 552,140 <u>6/</u><br>\$21,080,600 <u>7/</u> | 15,728,600 <u>6/</u><br><u>7/</u> \$27,852,500 <u>8/</u> | 3,025,021,000<br>\$1,745,437,000    | 11.74<br>57.700                | \$1,794,370,000                        |
| 1971 | 242,656,000        | 478,281 <u>6/</u><br>\$19,518,648 <u>7/</u> | 13,142,041 <u>6/</u><br><u>7/</u> \$20,312,339 <u>8/</u> | 2,677,569,000<br>\$1,377,073,737    | 11.03<br>51.43                 | \$1,416,904,724                        |
| 1972 | 266,831,000        | 484,552 <u>6/</u><br>\$28,297,837 <u>7/</u> | 14,655,772 <u>6/</u><br><u>7/</u> \$24,688,381 <u>8/</u> | 2,922,127,000<br>\$1,479,180,687    | 10.95<br>50.62                 | \$1,532,166,905                        |
| 1973 | 273,025,000        | 479,366 <u>6/</u><br>\$46,886,788 <u>7/</u> | 15,910,462 <u>6/</u><br><u>7/</u> \$40,691,961 <u>8/</u> | 2,902,524,000<br>\$1,708,425,626    | 10.63<br>58.86                 | \$1,796,004,375                        |

1/ U.S. Bureau of Mines. 2/ Doesn't include precipitate copper from dump and in-place leaching. 3/ E/MJ average price, domestic, f.o.b. refinery 4/ Based on first 8 months of 1967 5/ Based on last 9 months of 1968 6/ Does not include gold or silver recovered from vat or heap leaching of copper ores. 7/ At average domestic gold prices in "Metal Statistics, 1971": year 1968, \$39.26 per oz.; 1969, \$42.19; 1970, \$36.39; 1971, \$40.81; 1972, \$58.40; 1973, \$97.81 8/ At average E/MJ N.Y. market price for silver .999 fine.

TABLE XVI

## EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

## IN THE UNITED STATES AND ARIZONA

| Period | All Employees           |            | Production Workers      |            |                         |            |                      |            |                         |             |
|--------|-------------------------|------------|-------------------------|------------|-------------------------|------------|----------------------|------------|-------------------------|-------------|
|        | Ave. No.<br>(Thousands) |            | Ave. No.<br>(Thousands) |            | Ave. Weekly<br>Earnings |            | Ave. Weekly<br>Hours |            | Ave. Hourly<br>Earnings |             |
|        | 1/<br>Ariz.             | 2/<br>U.S. | 3/<br>Ariz.             | 4/<br>U.S. | 5/<br>Ariz.             | 6/<br>U.S. | 7/<br>Ariz.          | 8/<br>U.S. | 9/<br>Ariz.             | 10/<br>U.S. |
|        |                         |            |                         |            |                         |            |                      |            |                         |             |
| 1966   | 15.2                    | 31.9       | 12.4                    | 26.2       | 150.06                  | 140.07     | 45.2                 | 43.5       | 3.32                    | 3.22        |
| 1967   | 12.2                    | 25.4       | 9.0                     | 19.1       | 141.43                  | 140.18     | 42.6                 | 43.0       | 3.32                    | 3.26        |
| 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        |
| 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        |
| 1970   | 18.8                    | 37.0       | 14.9                    | 29.5       | 173.01                  | 175.67     | 43.8                 | 44.7       | 3.95                    | 3.93        |
| 1971   | 18.9                    | 34.7       | 14.9                    | 26.8       | 178.50                  | 178.46     | 42.4                 | 42.9       | 4.21                    | 4.16        |
| 1972   | 20.5                    | 38.9       | 16.1                    | 30.7       | 194.69                  | 192.19     | 41.6                 | 41.6       | 4.68                    | 4.62        |
| 1973   | 21.5                    | 42.3       | 17.6                    | 33.7       | 206.75                  | 206.42     | 41.6                 | 42.3       | 4.97                    | 4.88        |

|      | Production Workers                   |         |                                       |        | Copper Ore 10/<br>Shipped or Treated |         |
|------|--------------------------------------|---------|---------------------------------------|--------|--------------------------------------|---------|
|      | Ave. Earnings per<br>Man per Year 8/ |         | Aggregate Man-hours<br>(Thousands) 9/ |        | (Thousand Short Tons)                |         |
|      | Ariz.                                | U.S.    | Ariz.                                 | U.S.   | Ariz.                                | U.S.    |
| 1966 | \$ 7,803                             | \$7,284 | 29,145                                | 59,264 | 101,558                              | 186,966 |
| 1967 | 7,354                                | 7,284   | 19,937                                | 42,708 | 74,289                               | 127,066 |
| 1968 | 7,759                                | 8,407   | 24,820                                | 52,057 | 101,294                              | 170,054 |
| 1969 | 8,658                                | 8,788   | 32,092                                | 64,764 | 127,849                              | 223,752 |
| 1970 | 8,997                                | 9,135   | 33,936                                | 68,570 | 150,241                              | 257,729 |
| 1971 | 9,282                                | 9,280   | 32,852                                | 59,785 | 149,294                              | 242,656 |
| 1972 | 10,124                               | 9,994   | 34,827                                | 66,410 | 165,815                              | 266,831 |
| 1973 | 10,751                               | 10,734  | 38,072                                | 74,127 | 173,605                              | 289,998 |

(continued next page)



TABLE XVI (continued)

|      | Copper in Copper Ore <u>11/</u> <u>12/</u><br>(Recoverable Content)<br>(Thousand pounds) |           | Production Workers                         |       |                                                      |        |
|------|------------------------------------------------------------------------------------------|-----------|--------------------------------------------|-------|------------------------------------------------------|--------|
|      |                                                                                          |           | Copper Ore Mined<br>per Man-hour<br>(Tons) |       | Recoverable Copper<br>Mined per Man-hour<br>(Pounds) |        |
|      | Ariz.                                                                                    | U.S.      | Ariz.                                      | U.S.  | Ariz.                                                | U.S.   |
| 1966 | 1,474,447                                                                                | 2,805,136 | 3.485                                      | 3.155 | 50.590                                               | 47.333 |
| 1967 | 1,000,572                                                                                | 1,866,087 | 3.726                                      | 2.975 | 50.187                                               | 43.694 |
| 1968 | 1,252,919                                                                                | 2,349,046 | 4.081                                      | 3.267 | 50.480                                               | 45.124 |
| 1969 | 1,593,544                                                                                | 3,021,590 | 3.984                                      | 3.455 | 49.656                                               | 46.655 |
| 1970 | 1,826,734                                                                                | 3,368,957 | 4.427                                      | 3.759 | 53.829                                               | 49.132 |
| 1971 | 1,633,568                                                                                | 2,986,599 | 4.544                                      | 4.059 | 49.725                                               | 49.996 |
| 1972 | 1,816,618                                                                                | 3,264,113 | 4.761                                      | 4.017 | 52.161                                               | 49.151 |
| 1973 | 1,847,635                                                                                | 3,386,357 | 4.872                                      | 3.912 | 48.530                                               | 45.683 |

- 1/ These estimates of "All Employees," made by the Employment Security Commission of Arizona, in cooperation with the U.S. Bureau of Labor Statistics, 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. See note 2, Table 8 for explanation of differences between numbers of "Covered Employees" in Arizona Copper Mining in that table and those in this Table 16 for "All Employees," for the respective years.
- 2/ Estimates of "All Employees" in the United States industry division, "Mining-Copper Ores," which excludes copper smelting. The estimates have been made by the U.S. Bureau of Labor Statistics with the cooperation of the 50 states, and are based upon monthly samplings similar to those in 1/ above, adjusted periodically to census benchmarks.
- 3/ Estimates of production (non-supervisory) workers in Arizona Copper Mining, based upon samplings as in Note 1/.
- 3/a/ Estimate for 1947-49 is based upon assumption of the same ratio of "production" to "all" employees as that for the year 1949. The numbers of "All Employees" for the years 1947 to 1949 varied less than 2 percent from the average of 10,700 for the three years.
- 4/ Estimates of "Production or Non-supervisory Workers" in U.S. "Mining-Copper Ores," made as in 3/ above.
- 5/ Figures for "Average Weekly Earnings" are products of the figures for "Average Weekly Hours" and "Average Hourly Earnings" for the respective years.

(continued next page)

TABLE XVI (continued)

- 6/ The gross number of hours worked by production (non-supervisory) and related workers in a monthly sample period divided by the average number of the same workers in the corresponding period, provides the basis for the estimate of "average weekly hours" for the month. Averages for a year or period of months are arithmetical averages of the estimates for the months involved.
- 7/ 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. Average hourly earnings for a year or period of months are arithmetical averages of monthly estimates based on the results of the respective sample periods.
- 8/ "Average Weekly Earnings" times 52 weeks.
- 9/ Number of production workers times "Average Weekly Hours" times 52.
- 10/ Copper ore mined and shipped or treated by concentration, smelting or leaching.
- 11/ Recoverable copper from copper ore (Note 10/) and from copper precipitates from dump and in-place leaching.
- 12/ Copper from precipitates is held to be largely a byproduct of copper ores, similar to the gold, silver, molybdenum and other metals recovered from copper ores. In previous years, copper from precipitates has not been included in our tables similar to this one. For years prior to 1968, our tables have had added to the recoverable copper from ores a figure for "equivalent copper" computed by dividing the combined value of the byproduct gold and silver recovered from the ore, by the average price per pound of copper. The rapid increase in value of the annual recovery of molybdenum has made it rather pointless to continue this somewhat equivocal figure for "equivalent copper" without including the moly. In recent years copper precipitates have yielded value greater than that of the other byproducts combined. They require some labor from "Production Workers", and the inclusion of copper from precipitates as reported by the Bureau of Mines has some justification although its labor requirement is minor. The inclusion removes most if not all of the justification for a figure of "equivalent copper" - even with molybdenum added in its calculation.