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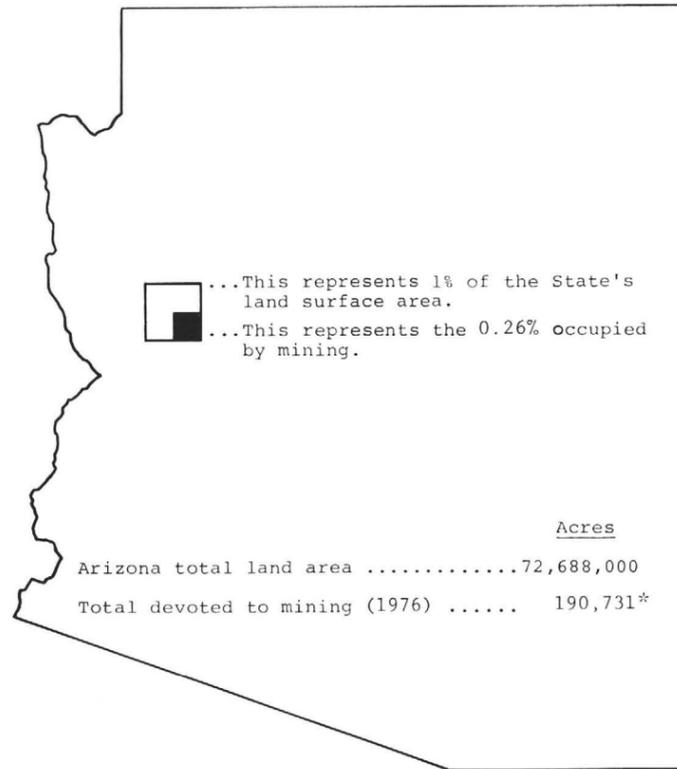
**ARIZONA:  
COPPER CAPITAL, U.S.A.**



**ARIZONA MINING ASSOCIATION**

THIS IS COPPER COUNTRY

Over half of our nation's newly mined copper comes from Arizona. That's more than all the other states combined produce. And it all comes from just a little over one-quarter of one per cent of Arizona's land surface...or about the area represented by the little square on the map. If all the mining properties in Arizona were lumped together, that's about how much of the state they'd cover.



	<u>Acres</u>
Arizona total land area.....	72,688,000
Total devoted to mining (1976)..	190,731

\* Approximately 0.26% (one-quarter of one per cent) of Arizona's land surface is occupied by mines, mills, smelters, waste disposal areas, roads, etc.

AN INVITATION

Visit an Arizona copper mine. Many copper mining companies offer public tours of their operations. The Arizona Mining Association has a free tour brochure listing the times and dates of tours, safety rules for visitors and whom to contact at the various companies. Just write or call us for it.

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MEMBER COMPANIES

AMAX ARIZONA, INC.

ASARCO

THE ANACONDA COMPANY

ANAMAX MINING CO.

CITIES SERVICE COMPANY

CYPRUS MINES CORPORATION

DUVAL CORPORATION

HECLA MINING COMPANY

INSPIRATION CONSOLIDATED COPPER COMPANY

KENNECOTT COPPER CORPORATION

MAGMA COPPER COMPANY

McALESTER FUEL COMPANY

HELPS DODGE CORPORATION

RANCHERS EXPLORATION & DEVELOPMENT CORPORATION

In its report accompanying the Tax Reform Bill of 1969, the U.S. House Ways and Means Committee stated that U.S. gold, silver, oil shale, copper and iron ore deposits must remain at the present 15 per cent depletion rate. The committee further stated that "present depletion rates appear to provide a proper balance between the need to encourage exploration and the discovery of new reserves on the one hand, and the revenue cost involved on the other hand." Projected future copper requirements make this conclusion equally sound today.

#### COPPER: THE FUTURE

There is throughout the copper industry, a prevailing optimism with regard to copper's long-range future. Most of us who have participated in its successes and failures recognize the industry's cyclical nature. We know of the peaks and valleys on any curve reflecting price. We also know that there is a general price up-trend.

The U.S. Bureau of Mines points out that as the world goes into the 21st Century, consumption of copper will rise at an annual rate of 3½% per year. This discounts substitutions and takes into consideration the national population and living standard growth. Nor is there any question that many areas of this world aspire to our American way of life -- which is impossible without copper!

The average American uses 20-25 pounds of copper per year in attaining our "good life." As less developed nations reach toward this lifestyle, it gives an almost infinite consumptive promise.

At this moment, the American market for Arizona's copper is weak. This does not say that American consumption of copper is weak, but merely that the American consumer is able to buy less expensive copper outside the United States. The European market for copper is less strong than ours and those materials normally sold in those markets are coming here instead.

The recession of 1976 led to an over-supply of copper throughout the world of about 2.2 million tons. This is about twice the normal working inventory in copper stocks. The surplus million tons of copper has depressed prices here, which has resulted in lay-offs and shutdowns. When these surpluses are gone, we expect, again, that copper will assume its normal, bright, role in Arizona's economic picture.

ARIZONA  
COPPER CAPITAL, U.S.A.  
1976

Facts about Arizona's  
copper mining industry,  
with latest statistics.

Prepared by  
The Arizona Mining Association  
Phoenix, Arizona

December 1977



# ARIZONA MINING ASSOCIATION

100 WEST CLARENDON • SUITE 1720 • PHOENIX, ARIZONA 85013 • (602) 266-4416

J. K. RICHARDSON  
President

November 1, 1977

The American copper industry is far from being "alive and well." Perhaps it would be better described as being "barely alive!" The continuing circumstances which lead to this unsatisfactory situation are common, today, to almost all natural resource producers. At any rate, the cry heard from the farmer and the rancher has a most familiar ring. We continue to struggle to stay alive long enough to meet the next mortgage payment and keep the hired man from moving away.

It is hard to believe that our copper is selling for less today than it was three years ago! This "bounty" comes despite spiralling costs attributable to wage increases; inflated equipment prices; non-productive regulatory compliance costs; taxes, and even, perhaps, some inefficiencies. All in all, some correction must and will take place in this area. Possibly the single largest element in this unprofitable selling role is the effect of world-wide copper stocks overhanging the market. The best estimates available indicate copper stocks of 2.2 million tons are available. This is about twice the world's normal requirement. During 1976 and the first half of 1977, the domestic market has been in approximate balance -- consumption and supply in a standoff position. This situation just doesn't get rid of surpluses! The whole copper world would be better off if there were about a million tons less in these stocks.

This great surplus is, largely, foreign produced copper. Copper is an international commodity which can be readily shipped anywhere in the world for 5¢ a pound. U.S. producers, despite a strong domestic demand, have been unable to obtain a satisfactory price. The other copper producing countries, not enjoying an equally strong demand, continue to maximize their production, regardless of price levels, hoping to earn enough foreign exchange to pay for OPEC oil. Traditional markets just can't absorb this production, so they sell it in the U.S.A.

The results, in Arizona, are significant layoffs in the copper industry, as well as mine shutdowns. The solution may well lie in a workable tariff or in a resumption of government strategic stockpile purchases. This latter seems most probable and offers the most immediate promise of relief. The surplus stocks must be normalized before our Arizona industry can play its normal role in Arizona's economy.

Sincerely,

## COPPER: PROPERTY TAXES, SEVERANCE TAXES AND DEPLETION ALLOWANCE

### Property Tax

Private property in Arizona is assessed at varying percentages of its "full cash value." The percentage depends upon the classification assigned a property. For example, residential and agricultural property is assessed at 15 per cent and 18 per cent, respectively, of their "full cash value." Business property is assessed at 27 per cent and utilities at 50 per cent. Mines and railroads, however, are assessed at 60 per cent of "full cash value" -- the highest classification in the book! Congress, in recently passing PL 94-210, denied all states, effective in 1980, the right to discriminate against railroad property, insofar as taxation is concerned. Congress has, thus, recognized the need for tax equity if railroads are to provide viable, competitive, transportation for the nation's goods. Common sense should dictate that inequity, wherever found, must and should be eliminated.

### Severance Tax

Arizona has a classic severance tax, even though it is called by another name. It is a tax upon the value of the mineral and forest products, sold or exported from the State. In the case of the mineral industry, it amounts to 2½ per cent of that value, regardless of the profitability of the operation. The severance tax is assessed, in addition to property, sales, income, payroll and miscellaneous taxes. Arizona's severance tax comes in three parts -- (1) Privilege Sales Tax; (2) Education Excise Tax; and (3) Special Excise Tax for Education. We have difficulty in seeing this as anything other than discriminatory taxation. There is no difference between our product and any other product sold and exported out of Arizona. Our State was most critical of New Mexico's tax upon power exported to Arizona -- no one liked paying New Mexico's "cost of government." Copper producers are unable to pass this severance tax on to the customer, for we must compete with other states as well as other nations -- so we must absorb such taxes. All if does is make Arizona's copper industry less viable than our neighbors or other lands which lack a similar tax.

### Depletion Allowances

Any company may depreciate buildings and equipment in order to have assets available to replace them when they wear out. An ore body cannot be replaced as it is being drawn upon. This is the reason the law permits a "depletion allowance." With the funds so generated, a mining company looks for, and when found, develops new ore bodies as the old one is being mined. Only in this way can a mining company stay in business.

Copper is an internationally traded metal. As earlier pointed out, approximately 59 countries produce copper which is sold and traded on three commodity exchanges. Most of the foreign copper is sold on the London Metal Exchange (LME). A similar market is the New York Commodity Exchange (COMEX) which serves interests in this country. However, most copper in this country is sold as a result of a U.S. "producers' price." This price is applicable to consumers who contract to purchase quantities of copper over a period of time.

"Scrap copper," usually produced from manufacturing processes, has always occupied a significant role in total copper production and is sold on an "over the counter" basis at quoted market prices.

The forms and purity of copper dictate prevailing price quotations. The most common are (1) Electrolytic refined wirebars and (2) Electrolytic refined cathode, both assaying not less than 99.90% copper, (3) Fire-refined copper in various classes, depending upon the degree of purity, and (4) Scrap copper either light or heavy.

Refined copper can be shipped here from almost anywhere in the world for about 5¢ per pound. Domestic prices must remain competitive with other markets. Prices react to many conditions, such as supply and demand, strikes, production costs, and political actions of various governments producing and marketing copper.

Although Arizona contributes significantly to this nation's copper supplies, its copper is not unique and must compete with copper produced elsewhere. Federal, State and local taxes, in addition to the cost of regulatory compliance, have a direct effect upon our ability to compete.

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ABOUT THE COVER

Firms manufacturing electrical products are among the biggest users of copper in America. Copper wire keeps them humming. This 1,000-foot reel of 10-gauge copper wire could be destined for any one of hundreds of domestic or industrial uses.

## COPPER: BUILDING ARIZONA THROUGH THE YEARS

Miners were among the earliest builders of Arizona. The miners today are still helping build Arizona's future. In large towns and small, the copper industry makes major contributions to Arizona's economic health.

### MAJOR SOURCES OF ARIZONA INCOME (BASIC INDUSTRIES)—1976

Tourism & Travel	\$2,625,647,000
Manufacturing Output (value added)	\$2,140,000,000
Mining Output	\$1,702,261,000
Agriculture (crops & livestock)	\$1,240,120,000

Source: Valley National Bank

### COPPER'S CONTRIBUTION: \$5.5 BILLION \*

The economic contribution of copper to Arizona's economy is measured in two ways: (1) Direct. Actual dollars paid by the industry for services and supplies. (2) Indirect. Additional dollars generated as those payroll and purchase dollars recirculate through the state's economy, buying more goods and services, with every dollar paying additional taxes right down the line.

The economic benefits add up. Directly and indirectly, in 1976, the State's copper industry provided Arizona more than \$5.5 billion in personal, business and government income.

\*Source: Southwest Economic Information Center

## AIR QUALITY

In 1969, Congress passed the National Environmental Policy Act. This Act was the first major action by government establishing a national policy to deal with the protection, maintenance and understanding of our environment.

Two years later, Congress approved the creation of the Environmental Protection Agency (EPA). Its job was to develop air quality standards, regulations, and the enforcement means to carry out Congress' intent. The agency's original staff called for 2,694 positions and an annual budget of \$204 million. By 1977 the staff had grown to 10,150 and its annual budget to \$784 million. This shocking growth of bureaucracy and attendant cost reflects legislative concern over the environment -- and lack of it for the consuming public. The public must bear the ultimate cost of it all.

Each ore, as well as each smelter, has its own unique characteristics. The existing technology available for meeting EPA and State standards worked in some cases and failed miserably in others. This "cut and try" method is still going on and so far has resulted in some 15 out of 42 U.S. non-ferrous smelters closing as regulatory EPA expenditures made continued operation uneconomic. Original EPA cost projections to bring all the non-ferrous smelters in the United States into compliance approached \$60 million. Arizona's copper industry, alone, with only seven copper smelters, has spent almost \$500 million and the job is still far from complete. One recently built smelter reports that over \$100 million of its total cost is attributable to EPA regulatory compliance.

Such costs as these have made it so easy for foreign copper producers to flood Arizona's normal copper markets. When this occurs, it takes jobs away from Arizonans and, eventually, raises every homeowner's property tax. One Arizona Congressman recently reported that environmental costs amounted to 15¢ per pound of copper.

The Copper Industry of Arizona supports realistic, technical and economically achievable environmental goals. We all desire, as present custodians of this earth, to keep its quality intact for future generations to use and enjoy as we have done. To insure this ability, we need to reach a constructive balancing of goals between aesthetic and resource values.

The copper mineralization in Arizona often contains other metals in varying quantities. If economically and technically feasible, these metals are separated from, refined, and sold as, by-products of copper. As a result of the huge tonnages of copper ore mined in Arizona, significant quantities of these other metals are also produced.

BY-PRODUCT PRODUCTION FROM ARIZONA COPPER OPERATIONS - 1976 \*

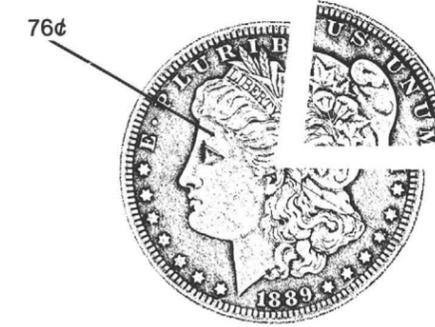
<u>Metal</u>	<u>Production</u>	<u>% of U.S. Production</u>	<u>Rank by State</u>
Molybdenum	31,073,000 lbs.	27.1	2
Silver	7,297,280 Tr. Oz.	21.5	2
Gold *	101,122 Tr. Oz.	9.8	4
* Estimated			

COPPER: LAND USE AND THE ENVIRONMENT

For geological reasons, the western states, including Alaska, offer the best targets for future mineral discoveries. The federal government, however, controls approximately one-third of the 2.27 billion acres in the fifty states; 93.5% of which are located in the twelve western states. However, the piecemeal withdrawal by Congress of these public lands from mineral access over the years is now equivalent to all of the land east of the Mississippi, with exception of Maine. Our annual, rising, domestic consumption of all minerals forces new ore bodies be found and developed to replace those we are now using. Imports of foreign minerals (that could have been produced domestically) mean loss of jobs, tax revenues, purchases of domestic goods and services, and a continuing increase in our adverse balance of payments.

The mining industry has never opposed legitimate withdrawals. It has, however, contended that Americans should know what mineral resources are being locked up for future generations -- otherwise who will know where to look when an emergency must be confronted. Lands subject to mineral exploration can be returned to other multiple use purposes without adverse environmental impacts. Re-vegetation and reclamation projects have already returned to other uses 40 per cent of the approximate 3.65 million acres earlier used for mining. As noted elsewhere in this report, the total land used for mining activities in Arizona is equivalent to about one-quarter of one per cent of the total land mass of the State. Compare that with land devoted to highways, agriculture, cities, housing developments, etc. This land that gives each of us so much is here to be enjoyed and its careful and intelligent development today makes its benefits available for future generations.

\* Source: U.S. Bureau of Mines



Of every dollar, 76 cents remained in Arizona.\*

Arizonans enjoy many benefits from the state's copper industry. Historically, dollars from copper have helped build towns, schools, hospitals, libraries and roads.

And in 1976, out of every dollar's worth of copper mined in Arizona, an estimated 76 cents remained in the state. It went for payrolls, pensions, taxes, purchases and permanent facilities.

(In addition, another \$299.3 million went out of state, in the form of federal taxes, equipment, services, out-of-state wages and salaries, debt service and dividends.)

PERSONAL INCOME: ONE OF EVERY EIGHT DOLLARS \*

One out of every eight dollars of personal income received in Arizona in 1976 can be traced to the mines. During 1976, personal income from copper in Arizona totaled \$412.5 million, an increase of more than \$52 million over 1975.

This represented about three per cent of the total personal income of all Arizonans. But it formed nearly 12 per cent of the State's basic personal income (which comes from agriculture, mining, export, manufacturing, tourism and the Federal government.) Directly and indirectly, then, the copper industry was responsible for one out of every eight dollars of personal income received in Arizona in 1976.

\* Source: Southwest Economic Information Center

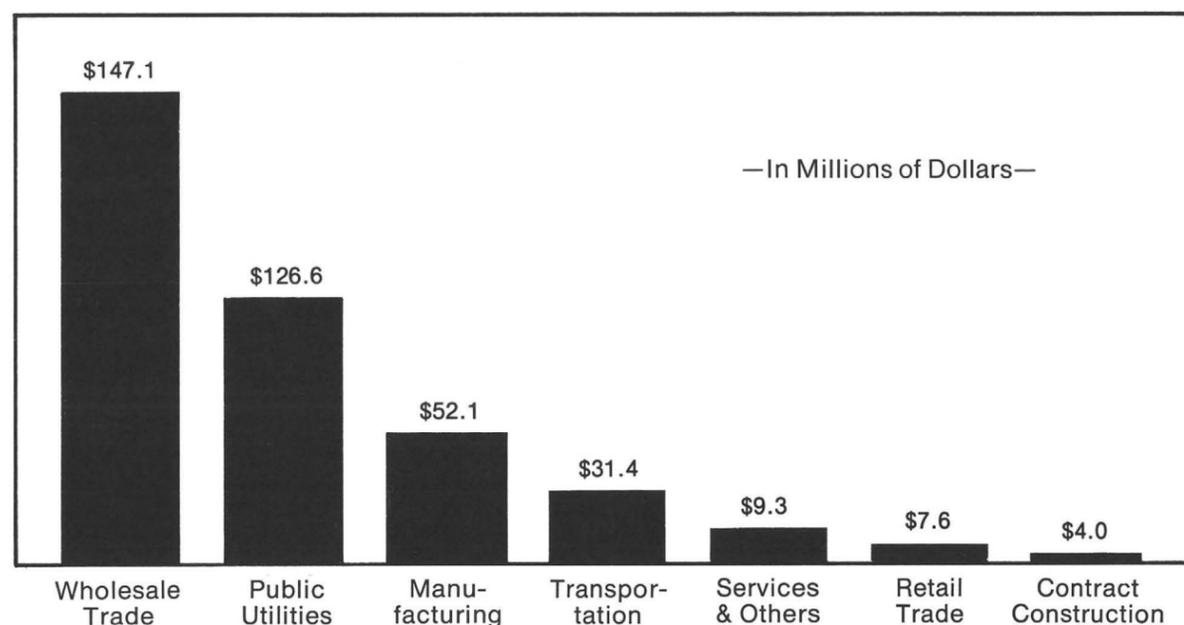
**COPPER: A MAINSTAY IN ARIZONA'S ECONOMY \***

Miners enjoy excellent pay. Combined wages and fringe benefits in 1976 amounted to \$462 million, or an annual average of \$17,980 for every employee. An additional \$12 million was spent for hospitals and recreational facilities in mining communities. These facilities are available to all residents of the mining community.

Over 70 per cent of the mines' equipment, fuel, supplies and other goods and services are purchased in Arizona.

Copper industry purchases in the state in 1976 totaled over \$379 million. Here's what that meant to other Arizona businesses:

Copper Mining Industry Purchases in Arizona — 1976



Source: Southwest Economic Information Center

Arizonans receiving these dollars in turn spent them with other Arizonans for goods and services they needed. Copper mining thus became directly and indirectly responsible in 1976 for more than \$3.5 billion in income to people working in other industries throughout Arizona. This was almost three times the value of its own sales!

\*Source: Southwest Economic Information Center

**A process of producing copper from copper oxide ores.**

Copper is removed from oxide ore by leaching — using sulfuric acid solution to dissolve the copper from the ore — in place, in heaps or in large vats.

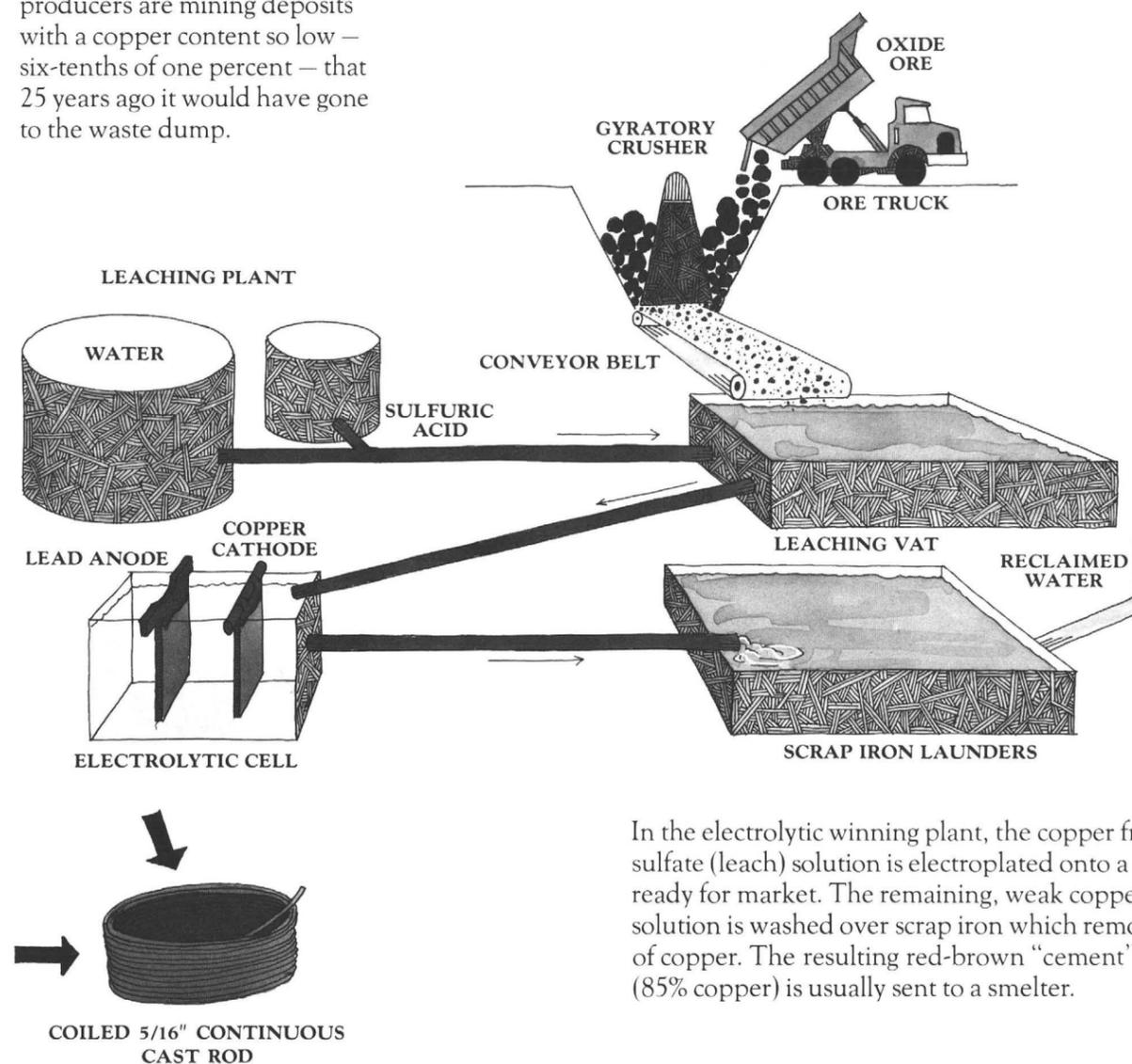
**Working low grade ores once considered waste.**

The “high grade” 5-10 percent copper ores of the early 1900s are nearly gone.

Today, Arizona copper producers are mining deposits with a copper content so low — six-tenths of one percent — that 25 years ago it would have gone to the waste dump.

The leaching process is being used at almost all Arizona copper mines to recover copper from low grade material, once considered too marginal to work. This is another conservation effort by the copper industry.

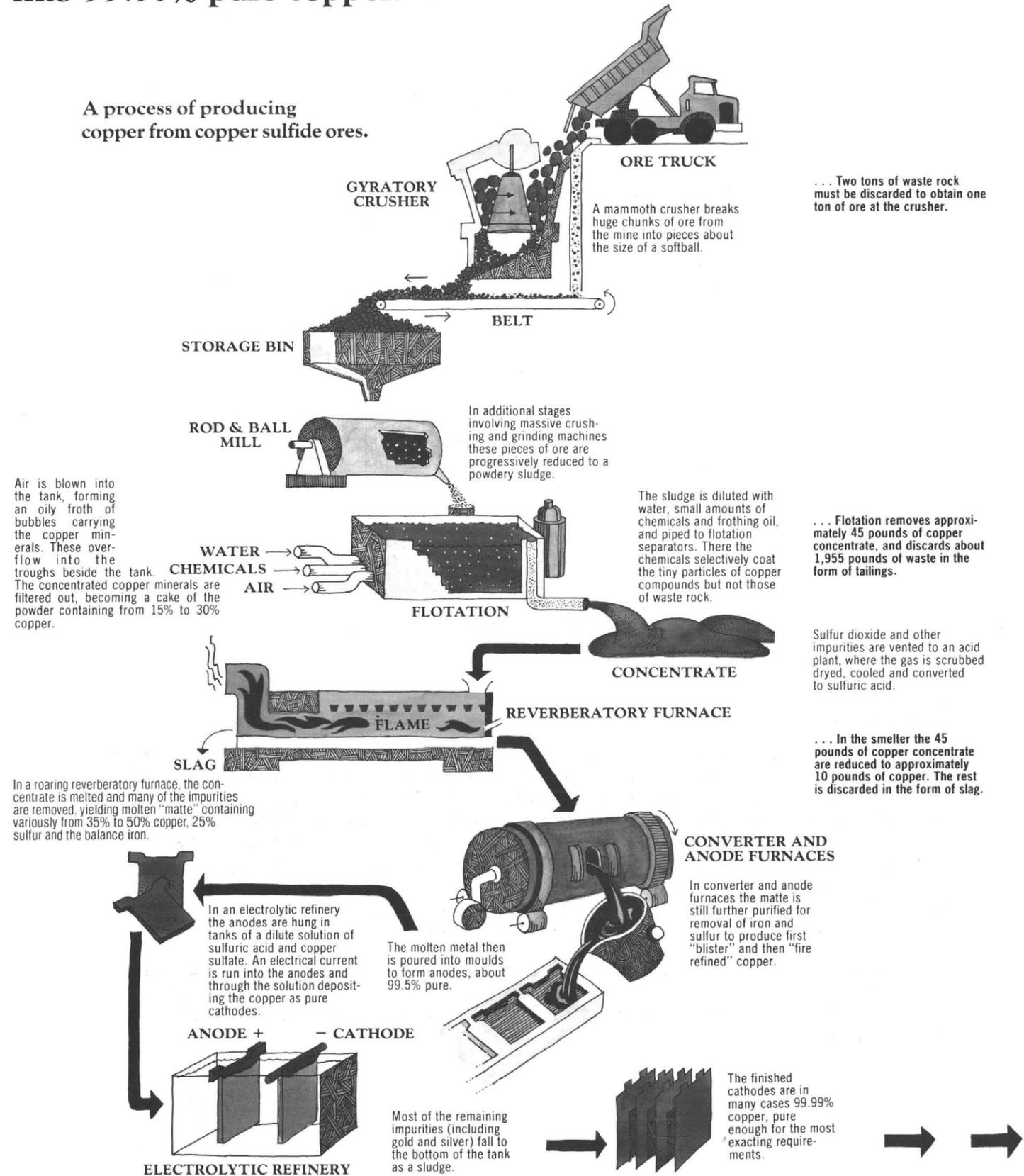
Year after year, Arizona's copper industry continues to produce over half the nation's new copper from low grade ores.



In the electrolytic winning plant, the copper from the copper sulfate (leach) solution is electroplated onto a cathode and is ready for market. The remaining, weak copper-bearing solution is washed over scrap iron which removes the last bit of copper. The resulting red-brown “cement” copper (85% copper) is usually sent to a smelter.

# Processing 0.6% low grade ore into 99.99% pure copper.

A process of producing copper from copper sulfide ores.



Note: Figures used are statewide industry averages and will vary at each operation.

## ONE OUT OF EVERY FOUR TAX DOLLARS FROM COPPER \*

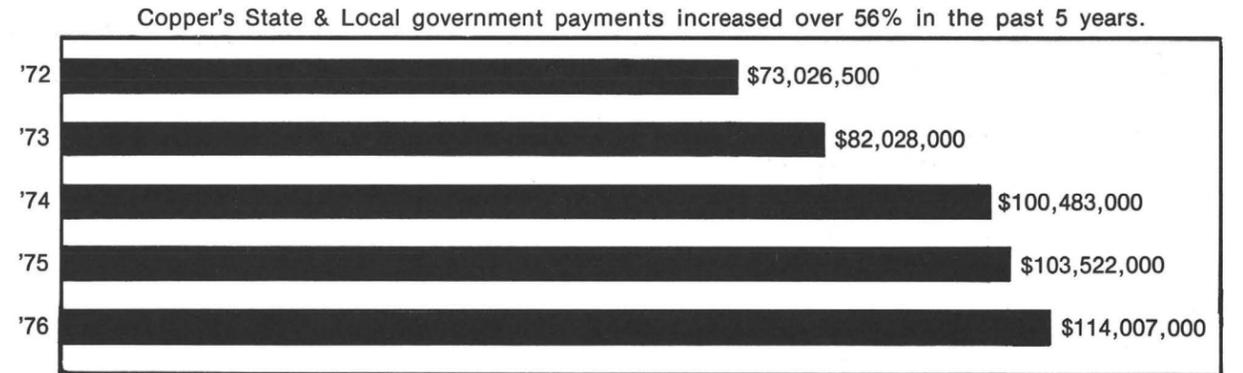
State and local government revenues generated by the copper industry help lighten the tax burden for every Arizonan. During 1976, the Arizona copper industry paid over \$114 million to support state, county and municipal governments and school districts statewide. This was up \$11 million from the year before.

These taxes were paid in various forms: through mining property taxes, severance taxes, corporate income tax, payroll taxes and sales taxes on Arizona purchases. There were also motor vehicle licenses, miscellaneous taxes and fees, and rents and royalties for the use of state lands.

It all adds up. As direct and indirect tax revenues generated by the mines recirculate through the state's economy, the combined effect is more than \$440 million for 1976.\* This was about one-quarter of all state and local tax revenues generated in Arizona.

Thus, although directly responsible for less than 10 per cent of state and local taxes in Arizona, the copper industry provided by direct and indirect means one of every four state and local tax dollars.

\* Source: Southwest Economic Information Center



Source: Southwest Economic Information Center

TOTAL STATE & LOCAL GOVERNMENT REVENUES  
 PROVIDED BY THE ARIZONA COPPER INDUSTRY  
 1974 - 1976

Amount Paid -- (In Thousands of Dollars)

<u>Type of Revenue</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Property Taxes	\$38,960	\$50,048	\$55,801
Severance Taxes <sup>a</sup>			
Privilege Sales Tax	12,105	9,808	12,050
Education Excise Tax	6,052	4,904	6,025
Special Excise Tax for Education	8,517	9,808	12,050
Corporate Income Tax	9,729	2,362	5,300
Payroll Taxes			
Unemployment Compensation	1,716	1,799	2,047
Workmen's Compensation	5,901	6,187	6,871
Miscellaneous Taxes <sup>b</sup>	11,445	13,037	11,636
Land Rentals and Royalties	<u>6,058</u>	<u>5,569</u>	<u>2,227</u>
Total	\$100,483	\$103,522	\$114,007

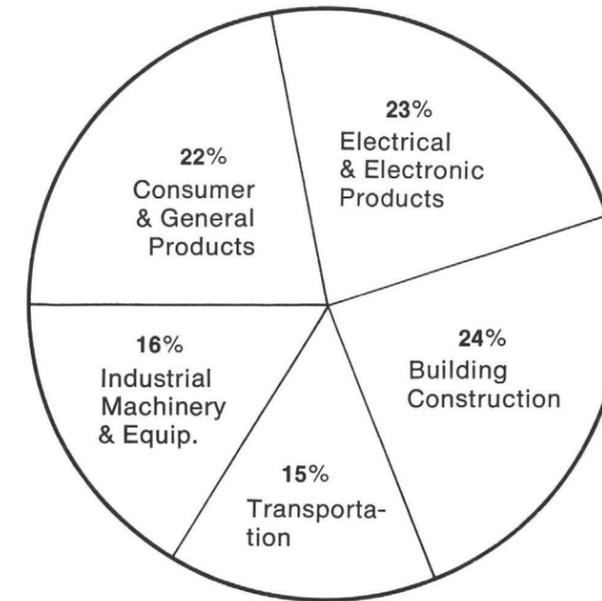
<sup>a</sup>Defined in Arizona as taxes paid on the value of mineral products sold or exported from the State.

<sup>b</sup>Includes sales taxes paid on Arizona purchases as well as motor vehicle licenses and fees.

\*Source: Southwest Economic Information Center

U.S. CONSUMPTION OF REFINED COPPER - 1976 - 1,988,200 TONS \*

The United States, in 1976, used 1,988,200 tons of refined copper. Listed below are the broad industrial using groups.



Source: Copper Development Association

COPPER: HOW IS IT PRODUCED?

Many of the early copper ore bodies in this country contained from five to ten per cent copper. They were the "bonanzas." Their existence, however, was short-lived and the grade of mineable ore decreased as a result of economic and technical limitations. In contrast, today's modern mines in Arizona are processing ores that average six-tenths of one per cent (.6%) copper. Through the application of modern technology, coupled with vast sums of private capital, Arizona's low grade mines are making copper available, as a usable product, for every man, woman and child in this country.

This illustration of a production process will, perhaps, make more understandable why millions of dollars of capital investment are needed in order that a mine can produce copper from such low-grade ores.

COPPER: WHERE DOES IT COME FROM AND WHERE DOES IT GO?

Copper occurs and is mined in varying quantities throughout the world. In 1976, approximately 59 countries produced copper. World production of newly mined copper was 8,713,740 tons. The United States produced 1,611,341 tons or 18.5 per cent of the world production. Arizona, the largest producing copper state, accounted for 63 per cent of the newly mined U.S. production and 11.6 per cent of the world production. Arizona is truly "Copper Capital, U.S.A."

WORLD PRODUCTION OF COPPER BY REGION - 1976 \*

	Production (short tons)	Per cent of total
North & South America	3,878,313	44.5
Europe	327,158	3.8
Asia	506,271	5.8
Africa	1,586,221	18.2
Australia/New Guinea	422,077	4.8
** Communist Block Nations (including Cuba & China)	<u>1,993,700</u>	<u>22.9</u>
	8,713,740	100%

UNITED STATES NEWLY MINED COPPER PRODUCTION BY STATE - 1976 \*

	Production (short tons)	Per cent of Total
Arizona	1,012,660	63.0
Utah	185,760	11.5
New Mexico	175,245	10.9
Montana	105,525	6.5
Nevada	57,480	3.6
Michigan	45,230	2.8
Other	<u>29,441</u>	<u>1.7</u>
Total	1,611,341	100%

Copper is one of the basic metals that is used by most of us all the time. Not only is copper the best metal for the conduction of electricity, but it readily alloys with over 100 other metals, is easily worked, and hourly contributes to our living standard.

\* Source: American Bureau of Metal Statistics

\*\* Estimated

ARIZONA STATE GOVERNMENT REVENUES

PROVIDED BY THE COPPER INDUSTRY

1974 - 1976

Source of Revenue	Amount of Revenue -- (Thousands of Dollars)		
	1974	1975	1976
State Property Tax	\$ 7,693	\$10,350	\$11,168
Severance Taxes <sup>a</sup>			
Privilege Sales Tax	5,011 <sup>b</sup>	4,061 <sup>b</sup>	4,989 <sup>b</sup>
Education Excise Tax	c	c	c
Special Excise Tax for Education	c	c	c
Corporate Income Tax	8,247 <sup>b</sup>	18 <sup>b</sup>	3,486 <sup>b</sup>
Payroll Taxes			
Unemployment Compensation	1,716	1,799	2,047
Workmen's Compensation	5,901	6,187	6,871
Sales Taxes on Purchases			
Privilege Sales Tax	1,165 <sup>b</sup>	1,314 <sup>b</sup>	1,186 <sup>b</sup>
Education Excise Tax	c	c	c
Special Excise Tax for Education	c	c	c
Motor Vehicle Taxes and Fees	185	341	180
Land Rentals and Royalties	<u>6,058</u>	<u>5,569</u>	<u>2,227</u>
Total	\$35,976	\$29,639	\$32,154

<sup>a</sup>Defined in Arizona as taxes paid on the value of mineral products sold or exported from the State.

<sup>b</sup>Excludes amounts shared with county and municipal governments.

<sup>c</sup>Although paid directly to the State general fund, all educational excise taxes are in fact distributed to the school districts.

\*Source: Southwest Economic Information Center

COUNTY GOVERNMENT REVENUES  
PROVIDED BY THE ARIZONA COPPER INDUSTRY  
1974 - 1976

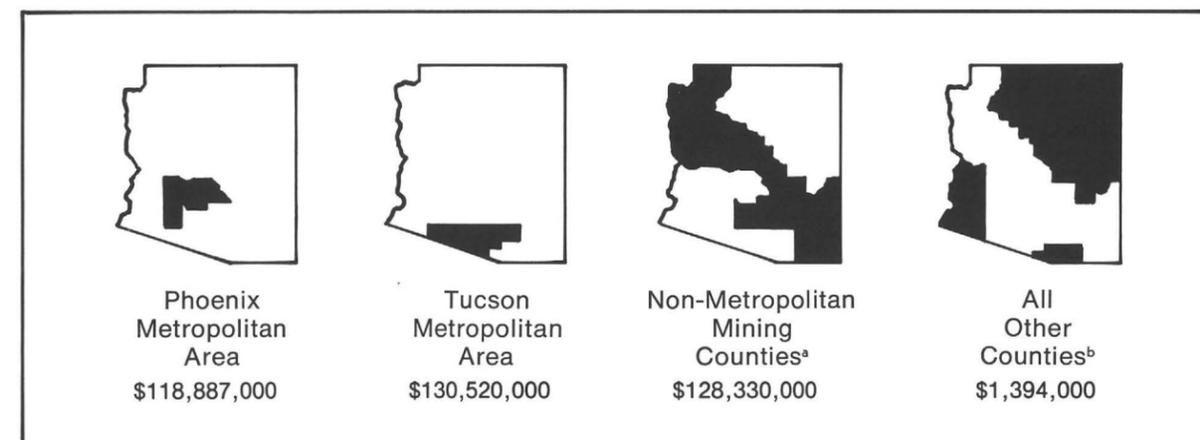
County	Amount of Revenue <sup>a</sup> -- (Thousands of Dollars)		
	1974	1975	1976
Pima	\$ 8,388	\$ 9,185	\$ 9,362
Pinal	2,426	4,045	4,541
Gila	2,033	3,256	3,846
Maricopa	2,622	2,345	2,576
Yavapai	402	480	770
Cochise	452	372	736
Greenlee	279	703	616
Mohave	255	533	350
Coconino	182	144	209
Yuma	155	137	152
Navajo	93	79	116
Graham	45	40	40
Santa Cruz	38	33	40
Apache	34	29	32
<b>Total</b>	<b>\$17,404</b>	<b>\$21,381</b>	<b>\$23,386</b>

<sup>a</sup>Contributed directly through the property tax and the automatic apportionment of privilege sales taxes collected by the State.

Source: Southwest Economic Information Center

Economic Sector	Goods and Services Purchased -- (In Thousands of Dollars)
Finance, Insurance and Real Estate	\$ 2,654
Services	5,220
Personal Services	\$ 578
Business Services	1,569
Automotive Repair Services	490
Other Repair Services	1,164
Miscellaneous Professional Services	1,160
All Other Services	259
<b>TOTAL ARIZONA PURCHASES</b>	<b>\$379,131</b>

**GEOGRAPHICAL DISTRIBUTION — 1976**  
All sectors of the State benefit from copper industry purchases.



a) Cochise, Gila, Graham, Greenlee, Mohave, Pinal, Yavapai Counties.

b) Apache, Coconino, Navajo, Santa Cruz, and Yuma Counties.

Source: Southwest Economic Information Center, based on data from the Arizona Department of Mineral Resources, the Arizona Mining Association, and individual copper producing firms.

INCOME TO OTHER ARIZONA BUSINESSES  
PROVIDED BY THE ARIZONA COPPER INDUSTRY

1976

<u>Economic Sector</u>	<u>Goods and Services Purchased --</u> <u>(In Thousands of Dollars)</u>
Agriculture	\$ 292
Other Mineral Industries	402
Contract Construction	3,958
Manufacturing	52,077
Lumber and Wood Products	\$ 1,355
Paper and Paper Products	371
Printing and Publishing	375
Chemicals	11,574
Rubber and Plastics	385
Stone, Clay and Glass Products	7,159
Primary Metals (except copper)	18,712
Fabricated Metal Products	7,579
Non-Electrical Machinery	2,784
Electrical Machinery and Equipment	1,480
All Other Manufacturing	303
Transportation	31,426
Communications	1,848
Public Utilities	126,569
Wholesale Trade	147,107
Automotive Equipment	23,335
Drugs and Chemicals	5,293
Apparel	3,187
Electrical Goods	8,429
Hardware, Plumbing and Heating Supplies	32,642
Machinery and Equipment	41,115
Petroleum Products	25,676
All Other Wholesalers	7,430
Retail Trade	7,579
Building Materials and Supplies	1,476
General Merchandise	1,211
Food	1,325
Automobile Dealers and Service Stations	2,490
All Other Retailers	1,077

MUNICIPAL GOVERNMENT REVENUES  
PROVIDED BY THE ARIZONA COPPER INDUSTRY

1974 - 1976

<u>Municipality</u>	<u>Amount of Revenue<sup>a</sup> -- (Thousands of Dollars)</u>		
	<u>1974</u>	<u>1975</u>	<u>1976</u>
Phoenix	\$ 2,209	\$ 2,370	\$ 2,349
Tucson	1,030	1,105	1,014
Mesa	249	267	339
Tempe	241	258	316
Scottsdale	255	274	262
Glendale	136	146	226
Hayden	124	125	210
Flagstaff	98	105	105
Yuma	109	117	101
Sierra Vista	65	70	68
Chandler	54	58	67
Prescott	53	57	57
Casa Grande	40	43	46
Douglas	50	52	42
Bisbee	49	49	37
Paradise Valley	27	29	31
Nogales	34	36	30
Winslow	30	33	27
Peoria	-	-	26
Globe	28	30	25
Kingman	28	30	25
Miami	-	38	23
Coolidge	-	-	23
Avondale	25	27	22
All other municipalities	428	435	309
Total	\$5,362	\$5,754	\$5,780

<sup>a</sup>Contributed directly through the property tax and the automatic apportionment of privilege sales taxes and corporate income taxes collected by the state.

Source: Southwest Economic Information Center

SCHOOL DISTRICT REVENUES PROVIDED BY  
THE ARIZONA COPPER INDUSTRY

1974 - 1976

School District	Amount of Revenue <sup>a</sup> -- (Thousands of Dollars)		
	1974	1975	1976
Mammoth-San Manuel Combined	\$ 2,526	\$ 2,925	\$ 3,518
Tucson No. 1 Combined	2,900	3,006	3,293
Sahuarita Unified	3,565	3,510	3,181
Superior Combined	860	1,311	2,528
Miami Unified	1,419	2,368	2,213
Morenci Combined	1,715	1,897	2,117
Hayden-Winkelman Unified	1,222	1,210	1,734
Ajo Unified	1,359	1,534	1,730
Bagdad Unified	654	872	1,604
Mesa Combined	1,281	1,335	1,500
Phoenix Union High School	1,241	1,320	1,450
Scottsdale Unified	1,338	1,345	1,428
Ray Unified	1,168	1,280	1,370
Washington Elementary	1,176	1,210	1,310
Glendale Combined	696	1,109	1,256
Marana Combined	842	1,126	1,022
Tempe Combined	866	918	1,015
Casa Grande Combined	-	-	829
Paradise Valley Combined	524	608	703
Cartwright Elementary	604	617	658
Douglas Unified	-	-	604
Yuma Combined	490	504	545
Sunnyside Unified	-	-	533
Roosevelt (Phoenix) Elementary	509	497	505
All other school districts	<u>11,523</u>	<u>12,626</u>	<u>12,101</u>
Total	\$38,478	\$43,128	\$48,747

COMMUNITY COLLEGE REVENUES  
PROVIDED BY THE ARIZONA COPPER INDUSTRY

1976

Community College District	Amount of Revenue <sup>a</sup>
Central Arizona	\$1,633,131
Pima	1,417,455
Yavapai	386,225
Cochise	198,547
Mohave	78,589
Eastern Arizona	2,333
Total	<u>\$3,716,280</u>

<sup>a</sup>Contributed directly through the property tax.

Source: Southwest Economic Information Center

<sup>a</sup>Provided directly through the property tax and the appointment of educational excise taxes.

<sup>b</sup>Combined, in all cases, refers to combined high school and elementary school districts.

Source: Southwest Economic Information Center



## **An invitation.**

Visit an Arizona copper mine. Many copper mining companies offer public tours of their operations. The Arizona Mining Association has a free tour brochure listing the times and dates of tours, safety rules for visitors and whom to contact at the various companies. Just write or call us for it.

### **Physical Properties of Copper**

Symbol – Cu... Atomic Weight – 63.54  
Specific Gravity – 8.96  
Melting Point – 1981.4°F.  
Boiling Point – 4700°F.  
Electrical Resistivity – Microhm-cm – 1.673  
Tensile Strength – H.D. – 60,000 pounds per  
square inch (annealed 30,000)  
Crystal Structure – Face-centered cubic  
Valence – one and two

### **ARIZONA MINING ASSOCIATION**

100 West Clarendon, Suite 1720  
Phoenix, Arizona 85013  
Telephone: (602) 266-4416

**MEMBER COMPANIES:** Amax Arizona, Inc. ASARCO, Inc. The Anaconda Company. Anamax Mining Company. Cyprus Mines Corporation. Duval Corporation. Hecla Mining Company. Inspiration Consolidated Copper Company. Kennecott Copper Corporation. Magma Copper Company. McAlester Fuel Company. Phelps Dodge Corporation. Ranchers Exploration & Development Corporation.

## The world around us.

The difficulties of meeting environmental restrictions can be staggering, too.

Arizona copper producers have spent upwards of \$500 million on environmental controls.

Mine by-product (waste) piles are being planted with grasses and trees. And the mines are backing research in atmospheric studies and in agricultural applications of sulfuric acid, a smelting by-product.

Water conservation has always been a fact of life for the mining industry. Industrial water is re-used up to eight times. Conservation has resulted, among other things, in the creation of mountain reservoirs enjoyed year-round by thousands of Arizonans.

Recycling is old hat to the copper industry. Because the metal is practically indestructible,

it has been melted down and used over and over again for centuries. In fact, the copper mined at the time the pyramids were built may still be in use somewhere today.

To have copper, you've got to have *ore* — which again is a copper mineral that can be mined at a profit. And ore is where you find it. It occurs in streaks and patches. It is difficult to predict, with any success, where ore bodies may be found. And again, they're worthless to anyone unless they're (1) accessible, and (2) high enough in grade and size that the metal can be profitably produced.

Deposits like that are not found just anywhere.

That's why access to land areas for exploration is so critical to industry and to anyone who uses mineral products from the earth. If areas are closed to mineral entry, present and future Americans are denied metals and minerals that are vital to their welfare and security.

In the face of increasing worldwide competition, such denial could become a critical problem, making America and its citizens more dependent on

unreliable and costly foreign sources of all mineral products.

The Interior Department has already predicted that by 1985, unless we develop more of our copper resources, this country will need to import 34 per cent of its domestic copper requirements. By the year 2000, the report says, we could be importing 56 per cent.

With public understanding, copper production will continue in Arizona. It will continue to be a job maker for the state, an economic boon to everyone who lives here, and a key source of one of man's most valuable and versatile metals.

Think back to our little play on imagination from the first page of this story, and what life might have been like on "the day you did without copper." And be glad it was only fantasy.

Because if Arizona's copper industry has anything to say about it, that day will never come!

## The day you did without copper.

These are some of the things you did without, the day you did without copper:

You had no lights.

No telephone.

No television.

No radio.

No shower.

No refrigerator.

No toaster.

No cooling.

No paper.

No change.

No car.

And no door knob.

Which didn't matter. You had no door keys, either.

Because this was the day you did without copper.

Every single one of those things is made with the eternal

metal, or relies heavily on it, or won't work without it.

Keys and cars and coins and coolers can't cut it these days without copper. It's one non-precious metal we'd have a hard time replacing.

For one thing, almost everything that runs with electricity relies on copper. Water pipes get their long lives from copper. The rivets on your jeans are rustless copper. Copper is sandwiched into our coins. The sturdiest keys — and locks made to last — come from brass, a stout copper alloy.

But copper's a bashful servant. Keeps pretty much behind the scenes. Yet even though you don't see too much of it, you can't do much without it. In fact, it's a safe bet you're using some right now. Wherever you are.

Here.

Or landing on the moon or Mars.

Copper.

It's man's eternal metal.

Man's most versatile metal.

Man's most durable metal.

And there's one state that mines more of this jack-of-all-trades metal than the other 49 lumped together.

Arizona!

## Man's oldest metal.

Arizona produces more copper than any state in the nation. We're big in copper. But we're just newcomers in the business.

Although copper has been on earth for millions of years, man has been using it only since roughly 8000 B.C. The day a wandering hunter in the Tigris and Euphrates river valleys stumbled across some native copper and figured out how to pound it into shape, he'd found more than just a way of making himself a better arrowhead.

He'd found man's first metal. Copper was here to stay.

### What's good enough for the pharaoh.

And that was true in more ways than one. We've been using the versatile metal ever since. And we've found out that *products* made from copper are here to stay, too.

Example: The Egyptian Pharaoh, Cheops, had some copper pipes installed in his bath. Dug up 50 centuries later, they were still good for carrying water. Things made of copper are made to last!

## From stone age to space age.

The Stone Age was doomed the day native copper was discovered. Once early man had learned how to use the easy-to-work "red metal," the days of the stone axe makers were numbered.

Their descendants one day would be picking up stones on the moon. The same red metal helped them get there. The Apollo command and service modules alone used almost 70 miles of copper wire. The massive communications and command systems on Earth employed far more.

Copper has long served man in so many ways because it possesses a unique combination of properties. It conducts heat better than any other metal except silver. It conducts

electricity better than any other common metal. It won't spark. It's non-magnetic. It resists corrosion. It's easy to work with and join to other materials, including plywood and vulcanized rubber. It alloys readily with other metals. The color is warm and appealing.

These very features predict a bright future for copper. From satellites to computers to office equipment to automation systems, power generators, electronic circuits, television, hospital X-ray and diagnostic equipment — anything using electricity — copper is the obvious choice.

Because it conducts heat so

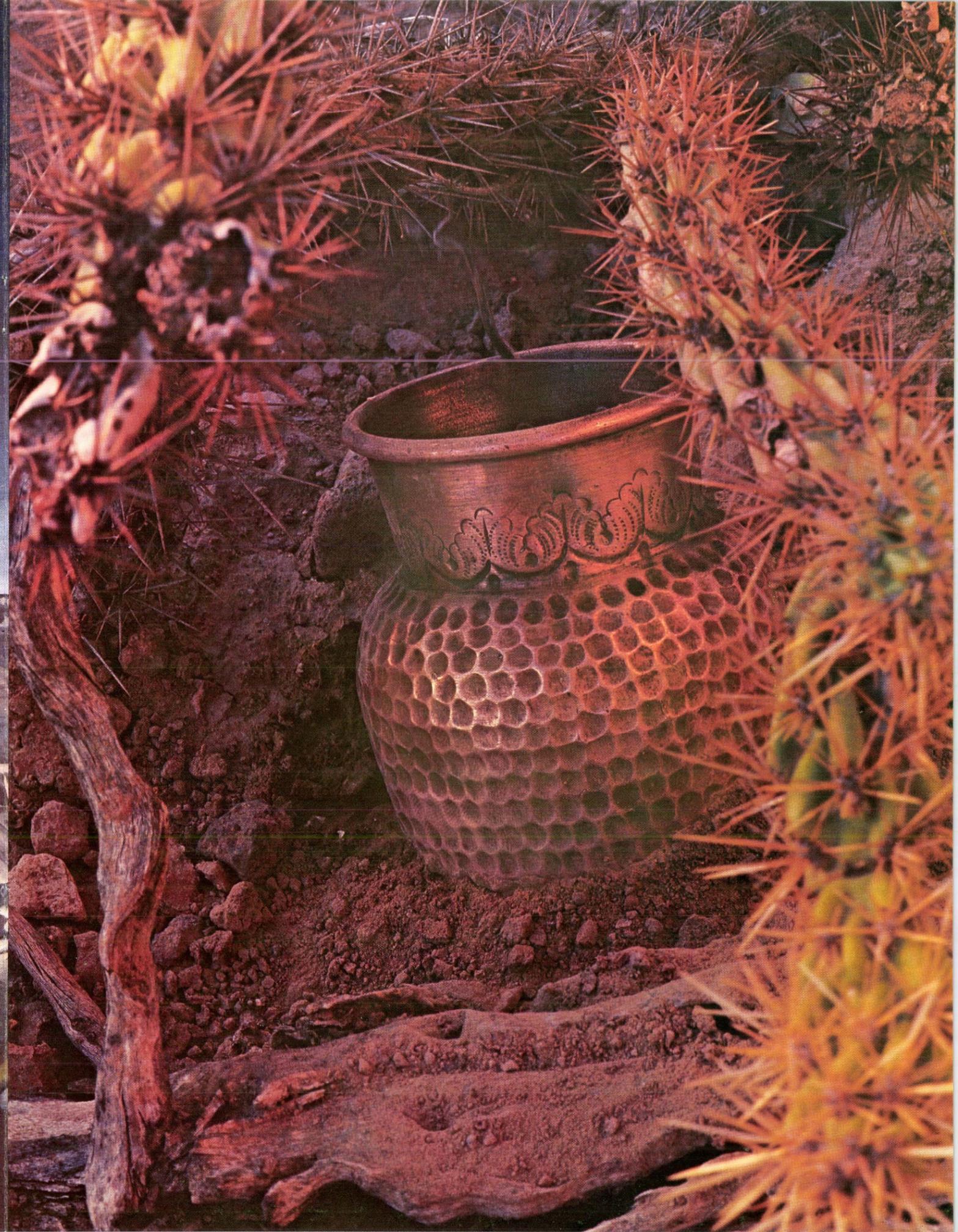
well and resists corrosion so successfully, it's a natural for solar energy systems. And for desalting ocean water. A copper-nickel alloy has made the hulls of a fleet of fishing boats practically barnacle-proof. Copper metals are lending a warm, human touch to the decorative trim of our newest office buildings and high-rise hotels, while providing at the same time the finest electrical, plumbing and sprinkler systems available anywhere. Future uses of copper? They'll be limited only by our imaginations.

Yes, our grandchildren will still be depending on copper. But they will have a much more difficult time exploring for new ore bodies, as more and more land is withdrawn from mineral exploration. Producing the metal will continue to be a challenge, too. Even today, it's a costly process requiring expensive equipment and skilled personnel.

But whatever the problems, we Arizonans must still turn out a product that can meet competition from producers all over the world. It's an exciting challenge — and a tough one.



Decade 80 solar home photo courtesy of Copper Development Association.



## Coronado missed the boat.

Man has used copper over the ages. Weapons, jewelry, coinage, tools were made from it. The hulls of boats were sheathed with it – including Columbus' Santa Maria. The mound-building Indians of Ohio buried their dead with imperishable noses of copper.

Man learned early to make alloys. Today these mixtures of copper and other metals in various proportions number over 200, and they're used for

everything from lipstick cases to ships' propellers. Bronze made lasting statuary. Brass was as tough as its name. Even Goliath wore a helmet of brass.

Copper was a valuable commodity for centuries. But when Coronado marched north out of Mexico in 1540 A.D., it wasn't the red metal he had on his mind. He was looking for gold.

He never found it. But he did walk right over fabulous deposits of copper. And, weary months later, walked right back over them again.

So, as they had for centuries, only the native Indians made any use of Arizona's copper.



## A process of producing copper from copper oxide ores.

Copper is removed from oxide ore by leaching – using sulfuric acid solution to dissolve the copper from the ore – in place, in heaps or in large vats.

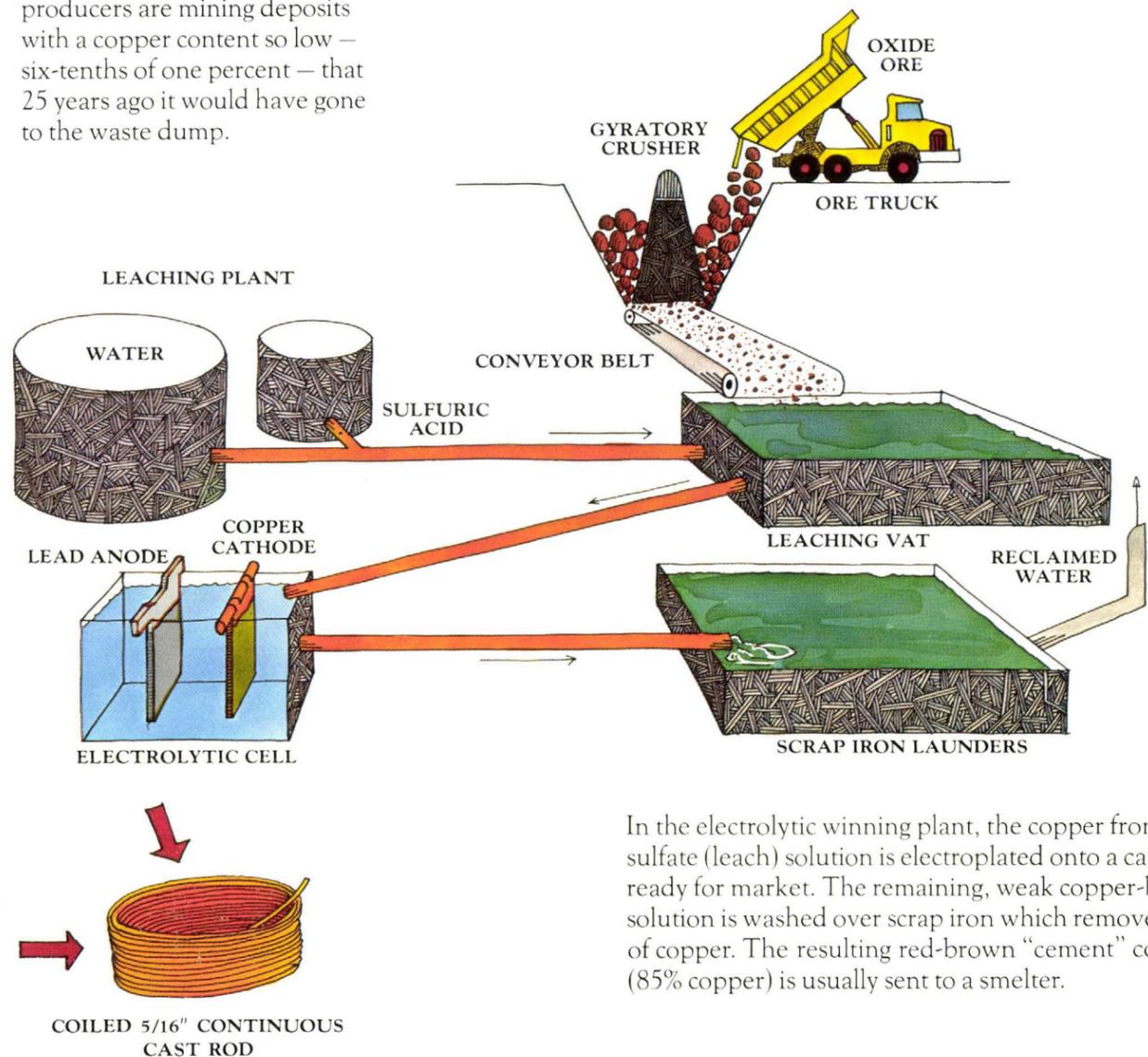
## Working low grade ores once considered waste.

The "high grade" 5-10 percent copper ores of the early 1900s are nearly gone.

Today, Arizona copper producers are mining deposits with a copper content so low – six-tenths of one percent – that 25 years ago it would have gone to the waste dump.

The leaching process is being used at almost all Arizona copper mines to recover copper from low grade material, once considered too marginal to work. This is another conservation effort by the copper industry.

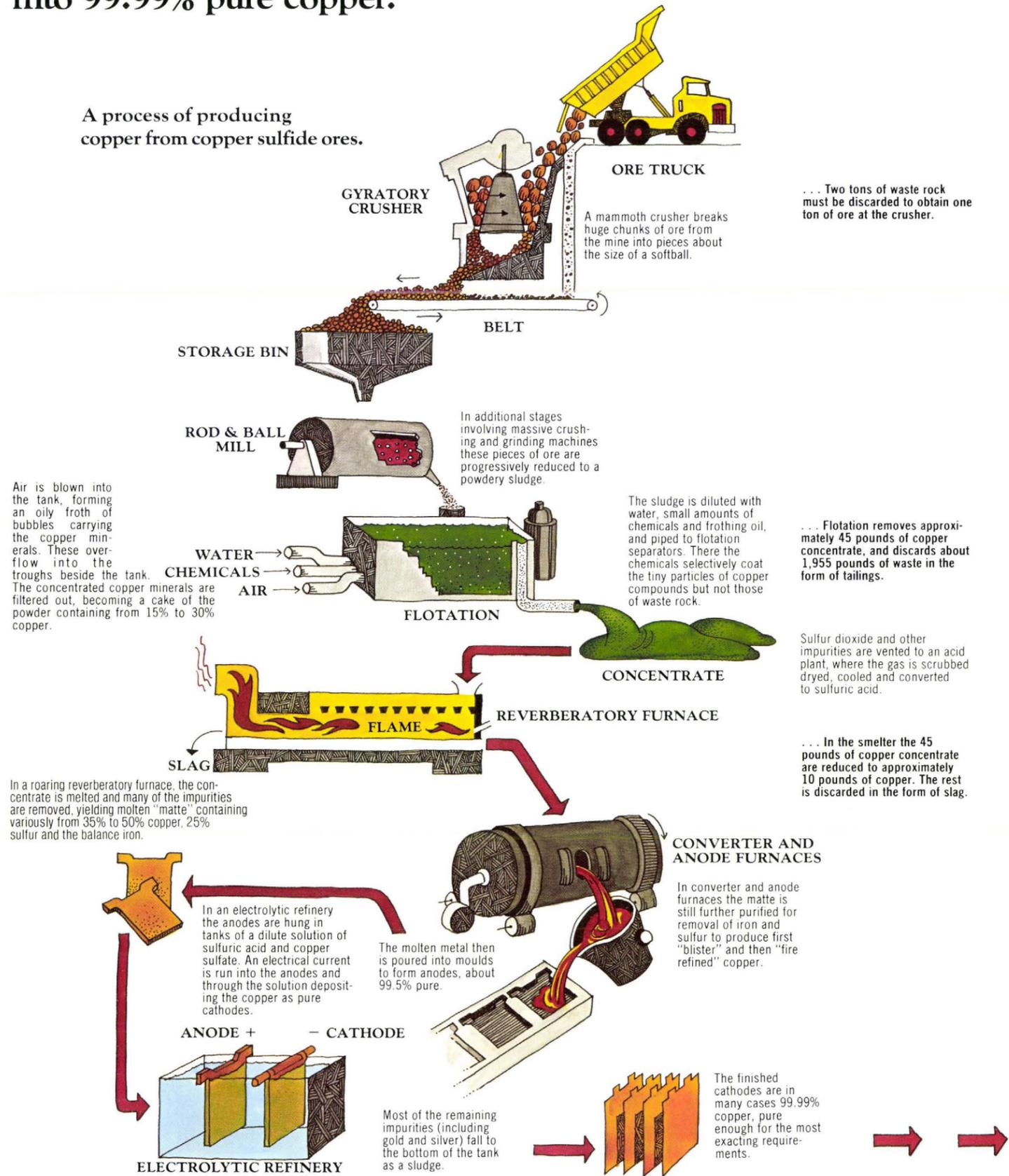
Year after year, Arizona's copper industry continues to produce over half the nation's new copper from low grade ores.



In the electrolytic winning plant, the copper from the copper sulfate (leach) solution is electroplated onto a cathode and is ready for market. The remaining, weak copper-bearing solution is washed over scrap iron which removes the last bit of copper. The resulting red-brown "cement" copper (85% copper) is usually sent to a smelter.

# Processing 0.6% low grade ore into 99.99% pure copper.

A process of producing copper from copper sulfide ores.



... Two tons of waste rock must be discarded to obtain one ton of ore at the crusher.

... Flotation removes approximately 45 pounds of copper concentrate, and discards about 1,955 pounds of waste in the form of tailings.

Sulfur dioxide and other impurities are vented to an acid plant, where the gas is scrubbed, dried, cooled and converted to sulfuric acid.

... In the smelter the 45 pounds of copper concentrate are reduced to approximately 10 pounds of copper. The rest is discarded in the form of slag.



Note: Figures used are statewide industry averages and will vary at each operation.

## Arizona, biggest copper state in the union.

It would be another three centuries before copper really put Arizona on the map.

Miners had come here first looking for gold. And silver. Found it, mined it, moved on. Oh, there was some copper, too. And it was mined, if the grade was high enough. But it wasn't until 1879 that the lights really went on for copper.

That was the year Thomas A. Edison perfected the electric light. Three years later there were central power plants and lighting systems operating in

New York City and in London. Their electric generators required miles of copper wire. Transmission lines demanded more. Industry, in response to consumer demand, required still more to satisfy growing energy needs.

Copper was needed — *urgently*. And Arizona had copper. Mining activity skyrocketed.

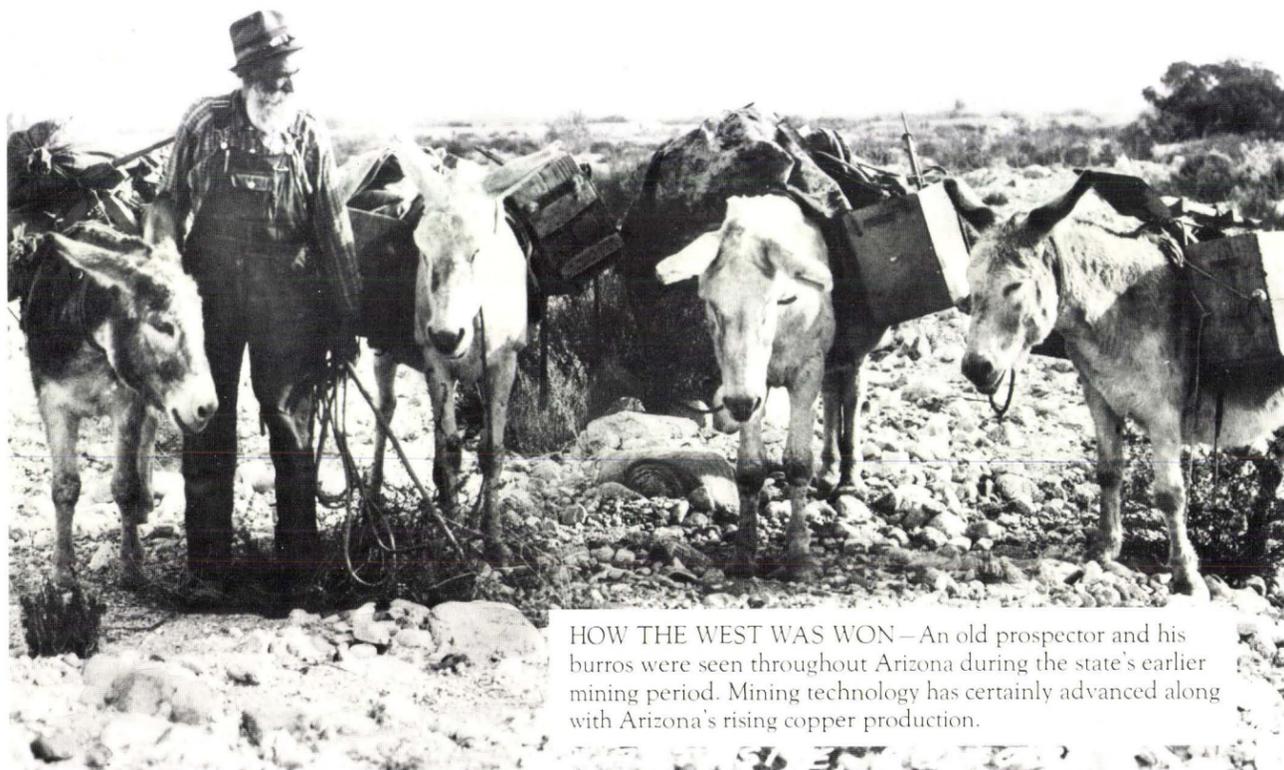
Since 1910, Arizona has been the nation's top copper producer.

these standards, is it ready to be made into rods, wire, sheets, bars, tubes, plates, strips and other forms, and put to work for man.

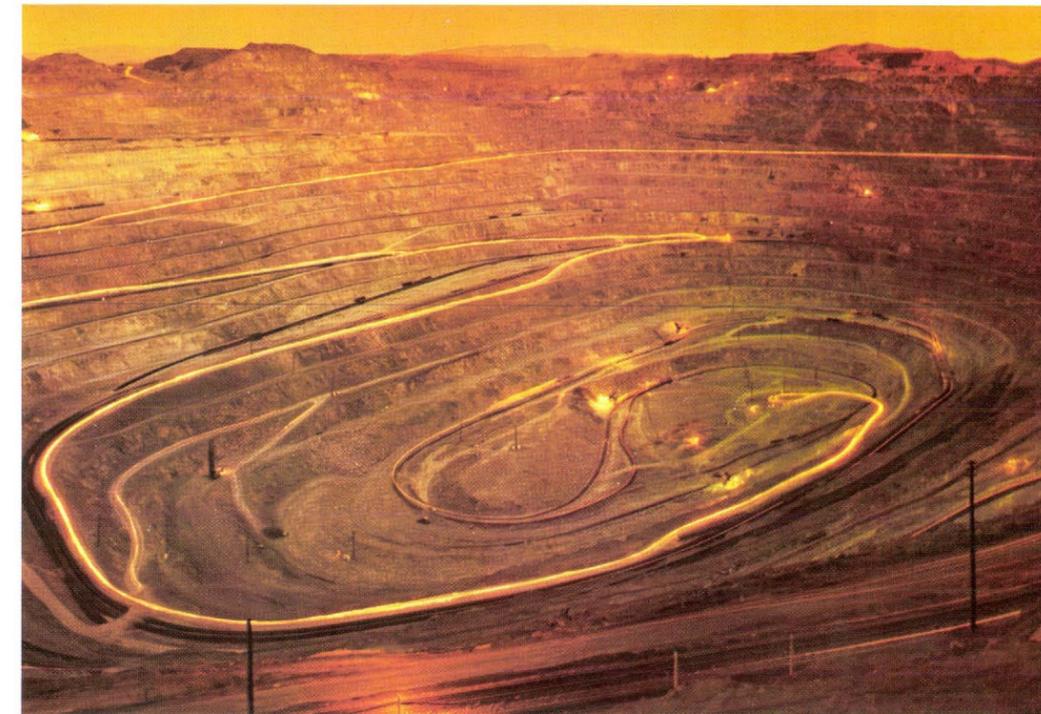
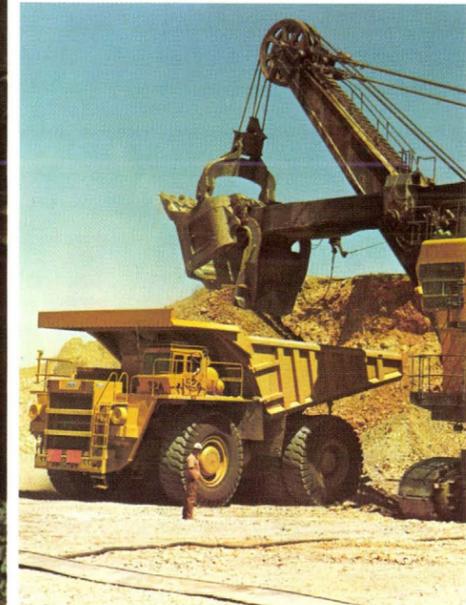
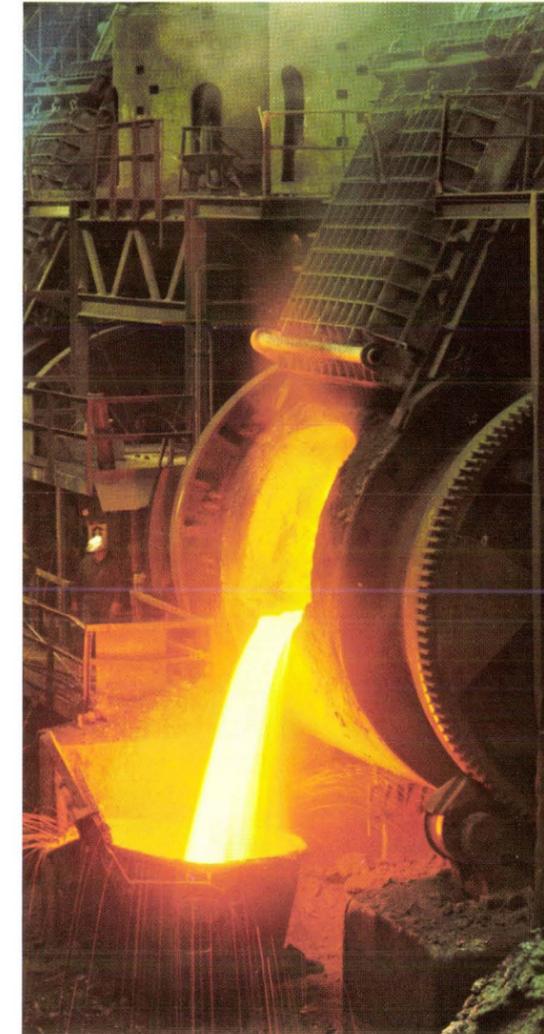
Finding copper in the first place, and then finding ways to make it work for us, is a job calling for all the curiosity, innovation and persistence that men and modern science can muster. It's no job for amateurs!

### Those valuable leftovers.

Arizona ranks first in the nation in copper production. But we come up with some other important metals, too. We're number two in silver production. We're number two in the production of molybdenum, important as a steel-toughening alloy, and used in automobiles, airplanes and oil refining equipment. Arizona also ranks fourth in the nation in gold production. Most of the silver, molybdenum and gold produced in Arizona are by-products of copper operations.



HOW THE WEST WAS WON — An old prospector and his burros were seen throughout Arizona during the state's earlier mining period. Mining technology has certainly advanced along with Arizona's rising copper production.





## It's only a rock until...

We hate to disappoint you, but these beautiful specimens are not the typical, everyday copper ores. The run-of-the-mill material is as drab as dishwater. True, there's a minute quantity of copper locked inside, but a rock is only a rock until man does something about it.

### Identify ore specimens.

Rock becomes ore only when technical ingenuity and huge investments by thousands of individual stockholders find ways to extract and sell the metal. And do it at a profit. And that in itself is quite a project. That's because the ores from today's underground and open pit mines contain so little copper — averaging less than six-tenths of one per cent.

In a typical mine, we have to haul away two tons of rock and dirt to obtain one ton of ore. And that, reluctantly, gives up about 10 pounds of copper.

### The oxide ores.

If the ore has been exposed to "weathering," a process which takes thousands of years, it will oxidize and can change its color to many shades of brilliant blues and greens.

The common oxide ores in Arizona's mines are Azurite, Chrysocolla and Malachite. Turquoise, a copper oxide mineral, is also found in some of Arizona's mines. To extract the copper from such minerals, the ore is often crushed and saturated with dilute sulfuric acid which dissolves the copper from the mineral and forms a solution called copper sulfate.

Through a process known as electrowinning, the copper is electroplated in metallic form on a pure copper sheet weighing about 10 pounds. The end product after seven days of electroplating is a pure 99.9 per cent copper cathode plate weighing approximately 110 pounds.

In order not to waste even lower grade copper materials, the material is often put in dumps through which dilute sulfuric acid is percolated. This copper-bearing solution is collected and placed in tanks containing tons of recycled tin cans.

The solution interacts with the iron in the cans, leaving a sludge which when dried is called "cement copper," a material containing approximately 80 per cent copper.

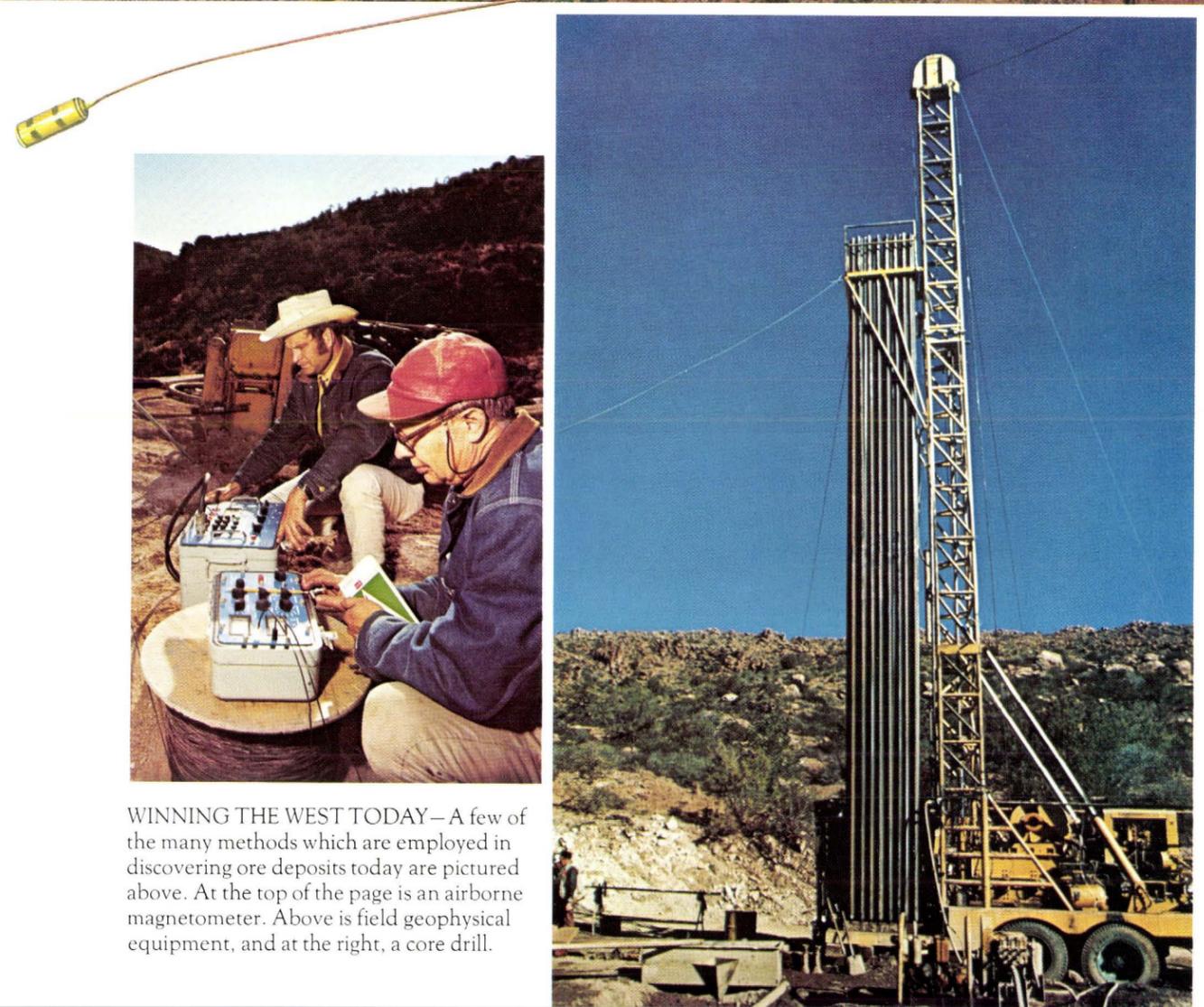
Cement copper in powder form is then sent to smelters for further processing into metallic copper.

### The sulfide ores.

If the ore has not been exposed to appreciable weathering, it maintains its basic form as a sulfide mineral. Common sulfide minerals found in Arizona's mines are Bornite (a peacock purple-blue), Chalcocite (a metallic grey) and Chalcopyrite (gold-like). These ores are crushed to a powder, treated with water and chemicals, and agitated. The desirable mineral elements separate from the waste material. The extracted copper concentrate, in powder form, is sent to a smelter for further processing.

At the smelter, fiery furnaces produce 700 to 800-pound slabs or "anodes" which are approximately 99.5 per cent pure copper.

This still isn't pure enough for most uses. The anodes are then sent to an electrolytic refinery to be converted by electric current to metallic copper that's 99.9 per cent pure. Only when copper has been purified to



WINNING THE WEST TODAY—A few of the many methods which are employed in discovering ore deposits today are pictured above. At the top of the page is an airborne magnetometer. Above is field geophysical equipment, and at the right, a core drill.

## One out of eight jobs.

Copper's a mighty important metal for Arizonans. Its presence creates jobs. In fact, about one out of every eight jobs in the state depends on the copper mines. That's counting the men and women who do the mining, milling, smelting and refining, and the thousands of other Arizonans who supply the tools, services and equipment the industry needs as well as providing miners and their families with food, clothing, shelter, education and entertainment.

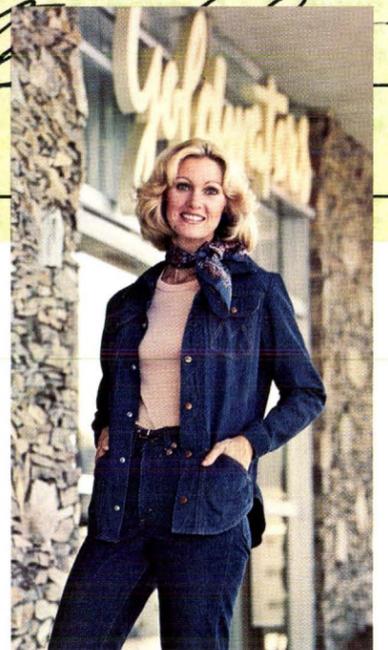
The mines are also good customers. Arizona copper producers purchase more than 70 per cent of all the goods and services they need from businesses in the state.

Tax revenues generated directly and indirectly by Arizona's copper industry amount to about one of every four tax dollars paid to state and local governments.

And the miners themselves are in turn good customers, thanks to the better than average wages and fringe benefits they receive.

All told, during an average year, the copper industry contributes to the Arizona economy 46 times the net value of resources removed from the earth.

And all this from an industry that uses only about one-quarter of one per cent of Arizona's land surface. To help you picture that, if you were the state of Arizona, the area occupied by mining would be less than that covered by your wristwatch.



# Arizona's Mines

Pay to the  
order of \_\_\_\_\_

ARIZONA'S MINERS

NO

\$ 5

FIVE



XTEEN AND 45/100

Do



The mineral exploration industry is as closely related to the earth we live on as any other industry or organization. The earth must not only supply us the material objects we require to sustain our existence with a reasonable standard of living, but it must supply us with an attractive and healthy place to live, work and play.

The men and women of the mineral exploration industry recognize that the disciplined use of our natural resources presents an opportunity to preserve our environment for future generations. The Department of Mineral Resources and the mineral exploration industry are in accord with the concept of multiple use of public lands.

There are three basic R's which should always be considered in environmental procedures during exploration programs:

**RESPECT** the environment you work in; it's the only one you have.

**RESTRAIN** from unnecessarily disturbing nature's balance.

**RESTORE** the natural setting of areas where you have worked to the maximum extent possible.



**ARIZONA DEPARTMENT OF  
MINERAL RESOURCES  
MINERAL BUILDING, FAIRGROUNDS  
PHOENIX, ARIZONA 85007**

# **ENVIRONMENTAL GUIDELINES FOR MINERAL EXPLORATION**

The ultimate responsibility for protecting the quality of our environment should be a cooperative endeavor to be shared by government, by private enterprise and by the individual citizen. As an aid to cooperation among these groups, the Department of Mineral Resources offers these Mineral Exploration Environmental Guidelines.

In all exploration activities we will comply with the following guidelines:

1. Know and observe Federal, State and local laws and regulations pertaining to mineral exploration. Special attention should be given to controls outlined in special use permits when such permits are required. In cases where the intent of the laws are to prevent unnecessary damage to the environment, the intent of the law should be observed above and beyond the letter of the law whenever possible.
2. Respect private property. Always obtain permission from property owners before starting operations or using any water or timber on their property.
3. Establish and maintain cordial relations with property owners and government officials having jurisdiction over land on which you are operating; respect their rights and obligations. At all times, whenever possible, discuss planned actions with owners and officials prior to starting operations and regularly throughout exploration activities.
4. Respect gates and fences so as to minimize disturbance of livestock. Leave all gates as found; open or closed. Observe signs posted by land owners. Repair any damage caused to fences and gates.
5. Avoid disturbance of vegetation and wildlife, to the extent feasible.
  - a. Keep vehicles on established roads whenever feasible.
  - b. Do not blaze trees or cut brush when establishing survey lines, except where necessary.
  - c. Construct roads and drill sites so as to minimize cuts and scars in the landscape.
  - d. Use drill holes instead of open pits for prospect and location work whenever possible.
  - e. Use minimum size equipment so as to reduce landscape damage caused by movement of equipment and construction of access roads.
  - f. Whenever possible, choose the location of drill-sites so that such sites and their access will be generally inconspicuous.
6. Restore to the maximum extent reasonable the natural setting of areas where you have worked.
  - a. Plug or cap drill holes.
  - b. Fill test pits and excavations when no longer needed.
  - c. Level or contour abandoned drill sites and excavations in a reasonable manner to limit erosion and aid natural restoration, and reseed.
  - d. Contour and construct water bars on access roads no longer needed to encourage natural restoration and limit damaging erosion.
  - e. Reseed former access routes.
  - f. All reseeding should be done with the type seed recommended by the appropriate Land Management Agency.
7. Avoid water, air and litter pollution.
  - a. Practice careful use of chemicals so as to avoid spillage that may cause water pollution.
  - b. Contain and handle petroleum products so as to avoid possible water pollution. Do not dump used petroleum products on the ground, but **remove from the area** and dispose of properly.
  - c. Avoid stream pollution from camp activities. Be especially careful with soap, detergents, etc.
  - d. Use proper mufflers on motorized equipment so as to avoid noise pollution.
  - e. Remove all wire, flagging, stakes and other extraneous material upon completion of surveys.
  - f. Remove all litter from the area. Do not burn or bury litter, but remove and dispose of properly.
  - g. Leave the area cleaner than when you arrived.
  - h. Remove physical evidence of claim location when claims are abandoned.
8. Prevent forest, brush or range fires. Carry fire fighting equipment such as shovels, picks and extinguishers in all field vehicles. Observe all fire prevention controls. Be aware of fire hazard levels. Be certain campfires are out before leaving an area. Be especially careful with cigarettes. Motorized equipment must have an acceptable spark arrester and/or muffler.
9. Observe all hunting and fishing regulations when on field assignments.
10. Promptly initiate negotiations with the owner or land management agency for settlement of any claims for damages resulting from exploration activities.

The mineral exploration industry is as closely related to the earth we live on as any other industry or organization. The earth must not only supply us the material objects we require to sustain our existence with a reasonable standard of living, but it must supply us with an attractive and healthy place to live, work and play.

The men and women of the mineral exploration industry recognize that the disciplined use of our natural resources presents an opportunity to preserve our environment for future generations. The Department of Mineral Resources and the mineral exploration industry are in accord with the concept of multiple use of public lands.

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**RESTRAIN** from unnecessarily disturbing nature's balance.

**RESTORE** the natural setting of areas where you have worked to the maximum extent possible.



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MINERAL BUILDING, FAIRGROUNDS  
PHOENIX, ARIZONA 85007

# ENVIRONMENTAL GUIDELINES FOR MINERAL EXPLORATION

The ultimate responsibility for protecting the quality of our environment should be a cooperative endeavor to be shared by government, by private enterprise and by the individual citizen. As an aid to cooperation among these groups, the Department of Mineral Resources offers these Mineral Exploration Environmental Guidelines.

In all exploration activities we will comply with the following guidelines:

1. Know and observe Federal, State and local laws and regulations pertaining to mineral exploration. Special attention should be given to controls outlined in special use permits when such permits are required. In cases where the intent of the laws are to prevent unnecessary damage to the environment, the intent of the law should be observed above and beyond the letter of the law whenever possible.
2. Respect private property. Always obtain permission from property owners before starting operations or using any water or timber on their property.
3. Establish and maintain cordial relations with property owners and government officials having jurisdiction over land on which you are operating; respect their rights and obligations. At all times, whenever possible, discuss planned actions with owners and officials prior to starting operations and regularly throughout exploration activities.
4. Respect gates and fences so as to minimize disturbance of livestock. Leave all gates as found; open or closed. Observe signs posted by land owners. Repair any damage caused to fences and gates.
5. Avoid disturbance of vegetation and wildlife, to the extent feasible.
  - a. Keep vehicles on established roads whenever feasible.
  - b. Do not blaze trees or cut brush when establishing survey lines, except where necessary.
  - c. Construct roads and drill sites so as to minimize cuts and scars in the landscape.
  - d. Use drill holes instead of open pits for prospect and location work whenever possible.
  - e. Use minimum size equipment so as to reduce landscape damage caused by movement of equipment and construction of access roads.
  - f. Whenever possible, choose the location of drill-sites so that such sites and their access will be generally inconspicuous.
6. Restore to the maximum extent reasonable the natural setting of areas where you have worked.
  - a. Plug or cap drill holes.
  - b. Fill test pits and excavations when no longer needed.
  - c. Level or contour abandoned drill sites and excavations in a reasonable manner to limit erosion and aid natural restoration, and reseed.
  - d. Contour and construct water bars on access roads no longer needed to encourage natural restoration and limit damaging erosion.
  - e. Reseed former access routes.
  - f. All reseeding should be done with the type seed recommended by the appropriate Land Management Agency.
7. Avoid water, air and litter pollution.
  - a. Practice careful use of chemicals so as to avoid spillage that may cause water pollution.
  - b. Contain and handle petroleum products so as to avoid possible water pollution. Do not dump used petroleum products on the ground, but **remove from the area** and dispose of properly.
  - c. Avoid stream pollution from camp activities. Be especially careful with soap, detergents, etc.
  - d. Use proper mufflers on motorized equipment so as to avoid noise pollution.
  - e. Remove all wire, flagging, stakes and other extraneous material upon completion of surveys.
  - f. Remove all litter from the area. Do not burn or bury litter, but remove and dispose of properly.
  - g. Leave the area cleaner than when you arrived.
  - h. Remove physical evidence of claim location when claims are abandoned.
8. Prevent forest, brush or range fires. Carry fire fighting equipment such as shovels, picks and extinguishers in all field vehicles. Observe all fire prevention controls. Be aware of fire hazard levels. Be certain campfires are out before leaving an area. Be especially careful with cigarettes. Motorized equipment must have an acceptable spark arrester and/or muffler.
9. Observe all hunting and fishing regulations when on field assignments.
10. Promptly initiate negotiations with the owner or land management agency for settlement of any claims for damages resulting from exploration activities.



# MINERAL INDUSTRY SURVEYS



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## THE MINERAL INDUSTRY OF ARIZONA, 1967

Plagued by a strike which closed most of the copper mining, smelting, and refining operations in Arizona, the total value of mineral production in the State declined \$158.2 million (25 percent) from the \$622.1 million reported in 1966 to \$463.9 million in 1967, according to the Bureau of Mines, United States Department of the Interior. Begun at most mines on July 15, the strike was in effect for the remainder of the year, and based on 1966 production resulted in a net loss of an estimated 305,600 tons of copper valued at \$234 million. Continued operations at five of the State's major copper mines--Bagdad, Esperanza, Mineral Park, Pima, and Silver Bell--together with high rates of production during the first half of the year limited the decline.

Mineral production centered on the metals group, representing \$415.3 million (90 percent) of the total value of mineral output. Accounting for 83 percent (\$383.6 million) of the total value of mineral output and 92 percent of the value of metals, copper was the primary metal produced along with its associated metals--gold, silver, and molybdenum. The value of uranium output was substantially lower (81 percent) because the U.S. Atomic Energy Commission's uranium allotment to the Orphan mine at the Grand Canyon was fulfilled in 1966, and the property shut down. The mine was reopened in September on a limited basis. Metals production occurred primarily in Pima, Pinal, Greenlee, and Gila Counties.

Closing of the copper mines by the strike also effected a decline in output of a number of nonmetallic minerals used in the processing of ores. Foremost of these minerals was limestone which declined 9 percent in quantity and 14 percent in value. Limestone is a basic chemical used at the large copper concentrators as flux in copper smelting, and in manufacturing lime.

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Table 1.--Mineral production in Arizona<sup>1/</sup>

Mineral	1966		1967	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays <sup>2/</sup> -----thousand short tons--	89	\$121	67	\$37
Copper (recoverable content of ores, etc.)--short tons--	739,569	535,004	501,741	383,591
Diatomite-----do-----	1,353	36	W	W
Fluorspar-----do-----			10,000	280
Gem stones-----	NA	120	NA	150
Gold (recoverable content of ores, etc.)---troy ounces--	142,528	4,988	80,844	2,830
Gypsum-----thousand short tons--	75	394	W	W
Helium <sup>3/</sup> -----thousand cubic feet--	63,500	2,222	73,800	2,066
Lead (recoverable content of ores, etc.)---short tons--	5,211	1,575	4,771	1,330
Lime-----thousand short tons--	218	3,721	186	3,142
Mercury-----76-pound flasks--	363	160	W	W
Molybdenum (content of concentrate)---thousand pounds--	10,161	17,812	9,261	15,385
Natural gas (marketed)-----million cubic feet--	3,161	436	1,255	193
Petroleum (crude)-----thousand 42-gallon barrels--	132	370	2,924	8,188
Pumice-----thousand short tons--	1,103	1,674	1,064	904
Sand and gravel-----do-----	18,730	20,448	16,580	17,017
Silver (recoverable content of ores, etc.) thousand troy ounces--	6,339	8,196	4,588	7,112
Stone-----thousand short tons--	2,271	4,091	1,910	3,491
Tungsten concentrate (60-percent WO <sub>3</sub> basis)-short tons--	2	5	W	W
Uranium <sup>4/</sup> (recoverable content U <sub>3</sub> O <sub>8</sub> )---thousand pounds--	437	3,492	83	666
Vanadium-----short tons--	W	453	W	W
Zinc (recoverable content of ores, etc.)---do-----	15,985	4,636	14,330	3,967
Value of items that cannot be disclosed: Asbestos, cement, clay (bentonite), feldspar, iron ore, mica (scrap), perlite, pyrites, vermiculite (1967), and values indicated by symbol W-----	XX	r/12,125	XX	13,503
Total-----	XX	r/622,079	XX	463,858
Total 1957-59 constant dollars-----	XX	r/509,867	XX	370,189

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

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

<sup>2/</sup> Excludes bentonite; included with "Value of items that cannot be disclosed."

<sup>3/</sup> Bureau of Mines estimate from non-company sources.

<sup>4/</sup> Method of reporting changed from short tons of ore and f.o.b. mine value (AEC Circular 5, Revised, price schedule) to recoverable pounds of uranium oxide and f.o.b. mill value.

Sand and gravel output, accounting for 45 percent (\$17.0 million) of the total value (\$38.1 million) of nonmetal output and 4 percent of the total value, was ranked second in the value of mineral commodities produced. Used extensively by the construction industry, this commodity declined 11 percent in output because of the decline in the total value of construction contracts awarded in Arizona last year. The decline in total value was the result of lower activity in heavy construction and slightly lessened activity in commercial and industrial building. Nonresidential building contracts were 3 percent lower in 1967, whereas heavy construction contracts dropped 26 percent. Residential building contracts rose 21 percent above 1966 levels. Production of cement was an important factor in the value of mineral commodities as it required the purchase or mining of clay, gypsum, stone, and other commodities.

The mineral-fuel output, entirely from Apache County, represented 2 percent (\$10.4 million) of the total value of mineral commodities produced in the State. Petroleum output accounted for most (\$8.2 million) of the value, followed by helium and natural gas. With the completion of the discovery well of the Dineh bi Keyah field in February 1967, petroleum production increased substantially. By the end of September the new field had 12 producing wells with a total daily output of 12,000 barrels.