

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

STATISTICS FOR 1961 COMPARED WITH OTHER YEARS

ARIZONA, UNITED STATES AND WORLD

COMPILED BY ARIZONA DEPARTMENT OF MINERAL RESOURCES
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C O P P E R

PHYSICAL PROPERTIES *

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 #/sq.in.) (annealed - 30,000)

Crystal Structure - Face-centred cubic. Valence - 1 & 2

Copper ranks next to iron as a metal of commercial importance. It has the best conductivity of any base metal; for example, measured on the ordinary basis of conductivity per unit of cross sectional area, aluminum's conductivity is only 61 percent of that of copper, but 3.5 times that of iron. Copper is therefore the most important metal in the electrical field. Copper has enough strength for minor structural purposes (such as sheet-metal work, electrical manufactures, etc.), is easily rolled and drawn into wire, has great resistance to weathering, and is of moderate cost compared to competitive materials. In addition to these properties, copper is widely used alloyed with zinc to form brass, which is easily worked, offers good resistance to weathering and most solutions (principal exceptions are certain acids and alkalies), and is fairly strong and elastic; and alloyed with tin to form bronze, of note for its resilience. It has good thermal conductivity, so finds many uses in heat-transfer units, such as cooling fins and water heaters. In addition, a large percentage of copper may be recovered as scrap after it has outlived the usefulness for which it was originally intended. Of the total copper consumed in the United States it has been estimated that about 60 percent eventually returns to use as copper or copper alloys.

* U.S.B.M.'s "MATERIALS SURVEY" - September, 1952

COPPER INDUSTRY IN 1961

Reported by U.S.B.M. in Mineral Market Report MMS No. 3426
Prepared July 9, 1962, by Don H. Baker, Jr., Gertrude N. Greenspoon
and Wilma F. Washington, under the supervision of P. F. Yopes, Chief,
Branch of Nonferrous Metals, Division of Minerals.

The copper industry in the United States in 1961 was marked by record mine production, a stable price, decreased imports, and a high rate of consumption, according to the Bureau of Mines, United States Department of the Interior. Domestic mine output exceeded 1960 by 8 percent mainly because of virtually uninterrupted operations at producing properties and the start-up of a new mine. The price of domestic copper rose to 31 cents a pound by the middle of May and remained unchanged for the remainder of the year. The return of the United States to a net-exporting nation, which began in 1960, became more pronounced in 1961. Imports dropped to the lowest since 1947 but exports of refined copper closely paralleled the high shipments in 1960. Demand for refined copper continued high and U. S. consumption rose 8 percent over 1960.

Production of copper in the United States totaled 1,165,200 tons and established a new record; the 1961 output was 6 percent above the former peak of 1,104,000 tons in 1956. Arizona supplied 50 percent of the total output; production rose 9 percent over 1960 and established a new record. The Mission project, 15 miles southwest of Tucson, an open-pit operation of American Smelting and Refining Company, was completed about six months ahead of schedule and production began in August. Utah continued to rank second among major copper-producing States but output fell 2 percent below 1960. A 21-day strike at the Utah Division of Kennecott Copper Corp. - the largest copper producer in the United States - was the chief reason for the reduced output. Third-ranked Montana's production was the largest since 1944, and represented a 13-percent increase over 1960. New Mexico rose to fourth place with output at the highest level since 1942 and an increase of 18 percent over 1960. Output in Nevada increased only slightly and the State dropped to fifth place. Michigan, in sixth place, produced 25 percent more copper than in 1960.

Consumption of refined copper increased 8 percent in 1961. In the first two months of the year copper was consumed at a rate of 12 percent below the 1960 monthly average. Consumption rose in March but dropped in April. By June use of refined copper reached the highest rate of the year (142,000 tons). Following the usual low of July because of vacations at many of the principal fabricators, consumption averaged more than 130,000 tons monthly through November. The December rate equalled the 1960 annual average.

The price for electrolytic copper quoted by primary producers was 30 cents a pound, delivered, at the beginning of the year. On January 17 producers reduced the price to 29 cents which held until May 1, when a principal producer raised the price to 30 cents; by May 3 all producers were at the 30-cent price. Shortly after the middle of May producers again advanced the price to 31 cents which became effective for all principal producers on May 19 and was unchanged at yearend. The custom smelter price closely paralleled the primary producers quotation. The price dropped to 29 cents on January 11 and was raised to 30 cents on May 1 but was withdrawn on May 16. On May 17 custom smelters quoted 31 cents and this price held through the end of the year.

Imports of unmanufactured copper decreased 13 percent and were the lowest since 1947. Receipts of refined copper dropped each year since 1953 except for 1959, and in 1961 were less than half the 1960 entries. Imports of blister, however, increased for the third successive year and were 14 percent greater than in 1960. The other unrefined classes - ore, concentrate and matte - were down 41 percent. Chile remained the chief source of imported copper supplying 50 percent of the 1961 total. Although Peru furnished slightly less copper than in 1960, it accounted for 20 percent of the total receipts, and rose to second place as a supplier. Canada, in second place since 1951, dropped to third place in 1961, furnishing only 17 percent of the U. S. total. Imports from Mexico, the Union of South Africa, and the Philippines declined.

Because the price of copper remained above 24 cents a pound, the 1.7-cents-a-pound excise tax, effective July 1, 1958, was unchanged.

Exports of refined copper, the principal export class, were little changed from 1960. West Germany, United Kingdom, Italy, Japan, and France were the major recipients, but substantial shipments were made to Brazil, India, and Argentina.

Exports of copper scrap declined sharply; Japan received the largest quantity, followed by Spain and West Germany. Brass and bronze scrap shipments dropped 5 percent from the 1960 record; 90 percent of the total went to Japan.

Stocks of refined copper at primary plants declined 50 percent; unrefined stocks decreased 10 percent to the lowest point since 1955. Data released in March 1962 on U. S. Government inventories of strategic materials as of December 31, 1961, revealed that 1,142,000 short tons of copper was stockpiled. Of this, 1,009,000 tons was in the national (strategic) stockpile, 122,000 tons in the Defense Production Authority inventory, and 11,000 tons in the supplemental stockpile. Included in these data were 21,066 tons of oxygen-free high conductivity copper in the national strategic stockpile and 5,199 tons in the supplemental stockpile. The maximum objective for copper was 1,000,000 tons.

The price of copper on the London Metal Exchange during January averaged £220 0s. 7d. per long ton (27.57 cents a pound). Prices trended upward until May when the high for the year was reached - £242 8s. 2d. (30.24 cents). Thereafter, quotations were at or near the equivalent of 29 cents. The average price for the year was 7 percent less than in 1960.

Production gains in many countries, notably Canada, Chile, and Peru, raised 1961 world mine output to a new high. The high rate was achieved despite production curtailments instituted in late 1960 and continued into 1961. Production rose 2 percent in Canada, 3 percent in Chile, and 9 percent in Peru. Output was virtually unchanged in Northern Rhodesia, and in the Republic of the Congo, production was adversely affected by the closure of the Union Minière du Haut Katanga operations in December. As a result of a strike at the Mount Isa mine, Queensland, from September 25 to November 22, production in Australia fell 16 percent below 1960.

OUTLOOK

As reported by Arizona Department of Mineral Resources

The stability of copper prices during the last two or three years indicates the willingness of copper producers to curtail output in order to keep supply and demand in reasonable balance. At the same time, the producers are maintaining

large exploration staffs, discovering and developing new copper deposits all over the world. Their efforts are meeting with success, and the industry is now organized to take care of unusual demand for copper, and thus avoid a runaway market like that in 1955 and 1956.

Practically all of the large copper companies have, by this time (July 1962), already made wage agreements with their labor unions, covering the next two or three years. Thus the danger of possible labor strikes has been averted, and the companies can go ahead with their new developments and the business of producing copper.

The Copper Products Development Association had a very successful year of research in 1961. This research has contributed materially in determining the value of copper as an alloy in gray iron castings. The Association expects copper to eventually capture from 30 to 50 percent of the 100,000-ton-a-year market in alloying elements used in manufacturing gray iron castings.

The Copper Institute figures for production of primary copper outside the U.S.A. for the first six months of 1962 show that these countries have continued to maintain the amazing production rate of the years 1960 and 1961, with very slight changes in stocks and refined copper deliveries.

COMMENTS ON TABLES XI, XII AND XIII

A study of United States copper production and consumption figures (Table XI), by years from 1946 to 1961 inclusive, brings out some pertinent statistics. The small increase in domestic consumption of refined copper is especially notable.

The average annual domestic consumption from 1946 to 1953 inclusive (8 years) was 1,376,978 tons, and from 1954 to 1961 inclusive (8 years) it was 1,394,046 tons, an increase of only 1.24 percent for the 8 years, or only 0.15 percent increase per year, where one might expect a normal growth-rate of at least 2 percent. The growth rate in production of refined copper for the two 8-year periods was 2.3 percent per year.

The other thing of note is that the United States has become self-supporting in copper production. This was the case in 1957, 1958, 1960 and 1961, and would also have been true in 1959 had the nation not suffered a loss of almost 300,000 tons in production due to the labor strike in the last five months of the year.

Mine productive capacity has reached 1,400,000 tons of copper per year, (See Table XII) and with an estimated added production of 300,000 tons of secondary unalloyed copper, this country is now well prepared to produce all the copper it will need for some time to come. Such capacity should permit economical operation for most of the big producers at an 85 to 90 percent of capacity during a recession or lull in demand.

Meanwhile, the copper tariff should be high enough to bar out low-cost foreign copper, as from now on domestic copper will be mostly high-cost, due chiefly to lowering grades of ore and rapidly increasing costs. The new producers, which have brought about this new productive capacity, must be kept active, not only for security reasons but for employment stability in a very important industry in our economy.

A tariff of at least 4 cents per pound of copper is shown to be justified by a study of Table XIII. For example, in the period 1959-1961, it took an annual average of 60,638,760 man-hours of labor at \$2.638 per hour to produce 127,144,000 tons of copper ore, with a recovery of 1,963,570,000 pounds of equivalent copper; a labor cost of \$159,965,049 for copper mining, or \$0.08147 per pound of copper. A recovery of 32.38 pounds of copper per man-hour of labor was made during this period.

If we assume a recovery of 81.0 pounds of copper per man-hour of foreign labor, (which assumes a minimum grade of only 2.5 times the U. S. ores), and a labor cost of only \$1.055 per man-hour, (which is 40% of U. S. hourly earnings), we arrive at a cost of \$0.01303 per pound of copper by foreign labor. This is 6.8 cents less than U. S. labor costs. As the object of a copper tariff was primarily to equate the difference in wage-rates, a proper tariff could be as much as 6.3 cents, (allowing a half-cent per pound freight rate on the foreign copper).

In order to insure continuous production of the number one strategic metal, the domestic copper industry must be protected against a flood of low-cost foreign metal. Our foreign aid program has helped the foreign producer to develop his copper production techniques, and he can find a ready market for his product in a rapidly expanding economy throughout the world. The growth-rate of copper consumption throughout Europe has been truly amazing. According to the Copper Institute figures for deliveries of refined copper outside the U.S.A., the average annual consumption of copper for the 8-year period (1946-1953) was 950,000 tons, and for the 8-year period (1954-1961) it was 1,700,000 tons. In 1961 alone it amounted to over 2,300,000 tons.

TABLE I

SALIENT U. S. COPPER STATISTICS

YEARS 1959, 1960 AND 1961

Compiled By Arizona Department of Mineral Resources from U.S.B.M. Reports

	1959	1960	1961
Arizona Mine Production - Tons Copper	430,297	538,605	587,053
U. S. Mine Production - Tons Copper	824,846	1,080,169	1,165,155
World Mine Production - Tons Copper	4,000,000	4,590,000	4,850,000
Refined Stocks - Beginning of Period	48,000	18,000	98,000
Refined Stocks - End of Period	18,000	98,000	49,000
Refinery Production (From Domestic Ores)	796,452	1,121,286	1,181,015
Refinery Production (From Foreign Ores)	301,795	397,641	369,124
Secondary Copper Recovered from Scrap as Unalloyed Copper	261,588	300,259	279,511
<u>IMPORTS:</u>			
Copper from Ore, Matte, Regulus	82,523	80,536	47,392
Blister Copper	287,665	296,160	340,312
Refined Copper	214,056	142,706	66,856
Total Imports - Crude & Refined	584,244	519,402	454,460
<u>EXPORTS:</u>			
Copper in Ores, etc.	2,981	11,111	4,478
Refined Copper	159,702	433,762	432,253
Total Exports - Crude & Refined	162,683	444,873	436,731
EXCESS IMPORTS OVER EXPORTS	421,561	74,529	17,729
<u>CONSUMPTION:</u>			
New Refined (Apparent Consumption)	1,183,000	1,148,000	1,234,000
Total Refined (Actual)	1,463,031	1,349,896	1,462,830
U. S. Mine Prod. % of Appar. Consumption ..	69.7	94.1	94.4
Average E. & M.J. Price of Copper	31.182¢	32.053¢	29.921¢

TABLE II

ARIZONA, UNITED STATES AND WORLD MINE PRODUCTION OF COPPER

E. & M. J. DOMESTIC AND EXPORT PRICE OF COPPER

By Years 1945 - 1961 Incl.

Source: U.S.B.M.

Year	ARIZONA			UNITED STATES		WORLD	E. & M. J.	
	Tons	% of U. S. Prod.	% of World Prod.	Tons	% of World Prod.	Tons	PRICE Per Pound	E.&M.J. EXPORT PRICE Per Pound
1945	287,203	37.2	12.0	772,894	32.2	2,400,000	11.775¢	11.700¢
1946	289,223	47.5	14.1	608,737	29.6	2,056,000	13.820¢	14.791¢
1947	366,218	43.2	14.6	847,563	33.9	2,500,000	20.958¢	21.624¢
1948	375,121	44.9	14.4	834,813	32.1	2,600,000	22.038¢	22.348¢
1949	359,010	47.7	14.4	752,750	30.1	2,500,000	19.202¢	19.421¢
1950	403,301	44.4	14.4	909,343	32.5	2,760,000	21.235¢	21.549¢
1951	415,870	44.8	14.3	928,330	32.0	2,900,000	24.200¢	26.258¢
1952	395,719	42.8	13.1	925,359	30.6	3,020,000	24.200¢	31.746¢
1953	393,525	42.5	12.9	926,448	30.4	3,050,000	28.798¢	30.845¢
1954	377,927	45.2	12.2	835,472	27.0	3,100,000	29.694¢	29.889¢
1955	454,105	45.5	13.3	998,570	29.2	3,420,000	37.491¢	39.115¢
1956	505,908	45.7	13.4	1,104,156	29.1	3,790,000	41.818¢	40.434¢
1957	515,854	47.5	13.3	1,086,141	27.9	3,890,000	29.576¢	27.157¢
1958	485,839	49.6	12.9	979,329	25.9	3,780,000	25.764¢	24.123¢
1959	430,297	52.2	10.7	824,846	20.5	4,020,000	31.182¢	28.892¢
1960	538,605	49.9	11.7	1,080,169	23.5	4,590,000	32.053¢	29.894¢
1961	587,053 1/	50.4	12.1	1,165,155 2/	24.0	4,850,000 3/	29.921¢	27.919¢

1/ Highest annual production in history of Arizona.

2/ Highest annual production in history of United States.

3/ Highest annual production in history of The World.

Arizona Department of Mineral Resources

August, 1962

TABLE III

MINE PRODUCTION RECOVERABLE COPPER - PRODUCTION SECONDARY UNALLOYED COPPER
REPORTED REFINED COPPER CONSUMPTION IN U.S.A.
ESTIMATED WORLD REFINED COPPER CONSUMPTION

	MINE PRODUCTION RECOVERABLE <u>1/</u>				SECONDARY COPPER PRODUCTION		
	United States	Rest of Free World	Communist Controlled	TOTAL WORLD	United States <u>1/</u>	Rest of World <u>2/</u>	TOTAL WORLD <u>2/</u>
1946	608,737	1,226,000	221,000	2,056,000	137,000	363,000	500,000
1950	909,343	1,551,000	300,000	2,760,000	261,000	460,000	721,000
1954	835,472	1,749,000	416,000	3,100,000	212,000	400,000	612,000
1956	1,104,156	2,171,000	515,000	3,790,000	273,000	537,000	810,000
1957	1,086,859	2,259,000	544,000	3,890,000	248,000	547,000	795,000
1958	979,329	2,217,000	584,000	3,780,000	255,000	525,000	780,000
1959	824,846	2,590,000	605,000	4,020,000	262,000	520,000	782,000
1960	1,080,169	2,829,000	681,000	4,590,000	300,000	550,000	850,000
1961	1,165,155	2,873,000	812,000	4,850,000	280,000	620,000	900,000

	CHANGE IN STOCKS	REPORTED CONSUMPTION	ESTIMATED CONSUMPTION
	Total World	United States <u>1/</u>	Total World <u>2/</u>
1946	8,000 I	1,187,000	2,548,000
1950	75,000 D	1,424,000	3,556,000
1954	141,000 D	1,254,000	3,853,000
1956	133,000 I	1,521,000	4,467,000
1957	104,000 I	1,348,000	4,581,000
1958	196,000 D	1,251,000	4,756,000
1959	30,000 I	1,463,000	4,772,000
1960	134,000 I	1,350,000	5,300,000
1961	20,000 D	1,463,000	5,730,000

1/ Source: U.S.B.M. 2/ Estimated. No official records have been published of either secondary unalloyed copper or of world consumption. Estimates are calculated from: "World Mine Production (U.S.B.M.) plus estimated secondary unalloyed copper, plus or minus change in stocks (Decrease or Increase)"

TABLE IV

WORLD MINE PRODUCTION OF RECOVERABLE COPPER
BY CONTINENTS AND PRINCIPAL COUNTRIES IN THOUSANDS SHORT TONS

Years 1957, 1958, 1959, 1960 and 1961

Source: U.S.B.M.

	1957	1958	1959	1960	1961
<u>NORTH AMERICA:</u>					
U.S.A.	1,087	979	825	1,080	1,165
Canada	359	345	399	438	450
Mexico	67	72	63	67	54
Other	18	14	10	13	11
	1,531	1,410	1,297	1,598	1,680
<u>SOUTH AMERICA:</u>					
Chile	535	515	602	587	604
Peru	63	59	53	202	218
Other	6	5	4	4	4
	604	579	659	793	826
<u>EUROPE:</u>					
U.S.S.R.	450	470	480	510	600
Yugoslavia	37	39	43	37	55
Others	122	129	141	147	154
	609	638	664	694	809
<u>ASIA:</u>					
China	17	33	33	77	110
Cyprus	44	37	40	39	32
Japan	90	90	93	98	106
Philippines	45	52	55	40	57
Turkey	29	28	31	30	32
Others	10	11	10	13	13
	235	251	272	306	350
<u>AFRICA:</u>					
No. Rhodesia	480	441	599	635	633
Belg. Congo	267	262	311	333	325
U. of So. Africa	51	55	56	51	58
Others	51	58	76	59	67
	849	816	1,032	1,078	1,083
<u>AUSTRALIA:</u>	64	82	104	121	102
<u>TOTAL WORLD</u>	3,890	3,770	4,040	4,590	4,850

TABLE V

NEW (PRIMARY) REFINED COPPER WITHDRAWN FROM SUPPLY ON DOMESTIC ACCOUNT

Years 1956-1961	Source: U.S.B.M.	Unit: Short Tons		
	Year 1956	Year 1957	Year 1958	
Ref. Prod. of New Cu from U.S. Ores.....	1,080,207	1,050,496	1,001,645	
Ref. Prod. of New Cu from Foreign Ores ..	362,426	403,680	350,875	
Total Ref. Prod. of New Copper	1,442,633	1,454,176	1,352,520	
Imports of Refined Copper	191,745	162,309	127,630	
Stocks at beginning of period	34,000	78,000	109,000	
TOTAL AVAILABLE SUPPLY	1,668,378	1,694,485	1,589,150	
Exports of Refined Copper	223,103	346,025	384,868	
Stocks at end of Period	78,000	109,000	48,000	
TOTAL	301,103	455,025	432,868	
Withdrawn on Domes.Acc.(Apparent Cons.).	1,367,275	1,239,000	1,157,000	
Reported Actual Consumption	1,521,389	1,352,124	1,250,677	

	Year 1959	Year 1960	Year 1961	
Ref. Prod. of New Cu from U.S. Ores	796,452	1,121,286	1,181,015	
Ref. Prod. of New Cu from Foreign Ores..	301,795	397,641	369,124	
Total Ref. Prod. of New Copper	1,098,247	1,518,927	1,550,139	
Imports of Refined Copper	214,056	142,709	66,855	
Stocks at beginning of period	48,000	18,000	98,000	
TOTAL AVAILABLE SUPPLY	1,360,303	1,679,636	1,714,994	
Exports of Refined Copper	158,938	433,762	432,253	
Stocks at end of period	18,000	98,000	49,000	
TOTAL	176,938	531,762	481,253	
Withdrawn on Domes.Acc.(Apparent Cons.).	1,183,000	1,148,000	1,234,000	
Reported Actual Consumption	1,463,031	1,349,896	1,462,830	

TABLE VI
IMPORTS OF COPPER INTO UNITED STATES
BY QUARTERS IN 1961

Source: American Metal Market

1961	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Yr. 1961
Ore Matte & Regulus (Copper Content)	15,002	4,863	13,565	13,962	47,392
Canada	4,922	1,932	4,781	2,897	14,532
Chile	1,281	-	-	712	1,993
Mexico	172	6	41	79	298
Peru	2,613	1,798	1,707	1,513	7,631
Philippines	3,741	-	3,969	6,187	13,897
U. of So. Africa	1,952	696	2,497	2,130	7,275
Australia	108	222	219	277	826
Bolivia	195	200	342	167	904
Other Countries	18	9	9	-	36
Blister Copper (Copper Content)	90,038	82,591	76,146	91,437	340,212
Mexico	6,004	6,979	5,976	1,560	20,519
Chile	59,849	54,972	48,579	59,142	222,542
Peru	20,574	15,386	18,270	28,517	82,747
U. of So. Africa	3,611	5,254	3,321	2,218	14,404
Refined Cathodes & Shapes	15,854	14,259	16,422	20,321	66,856
Canada	15,624	14,233	15,680	16,123	61,660
Chile	200	-	-	1,783	1,983
United Kingdom	-	-	688	613	1,301
Rhodesia & Nyasaland	-	-	-	1,797	1,797
Other Countries	30	26	54	5	115
TOTAL IMPORTS	120,894	101,713	106,133	125,720	454,460
TOTAL EXPORTS	157,084	106,812	72,849	99,986	436,731
EXCESS IMPORTS			33,284	25,734	17,729
EXCESS EXPORTS	36,190	5,099			

SUMMARY OF YEARS 1953-1961 INCLUSIVE

	1953	1954	1955	1956	1957	1958	1959	1960	1961
TOTAL IMPORTS	668,856	585,551	580,521	590,004	587,863	488,410	584,244	519,402	454,460
TOTAL EXPORTS	110,179	218,320	207,105	236,253	361,490	396,343	162,683	444,873	436,731
EXCESS IMPORTS	558,677	367,231	373,416	353,751	226,373	92,067	421,561	74,529	17,729

TABLE VII

EXPORT OF COPPER FROM THE UNITED STATES
BY QUARTERS IN 1961

Source: A.B.M.S. From Bureau of the Census
Compiled by Quarters by Arizona Department of Mineral Resources

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1961
Ore, Concts. & Matte	1,893	424	280	1,881	4,478
Refined Ingots, Bars, etc.	155,191	106,388	72,569	98,105	432,253
Argentina	5,346	2,916	2,160	2,464	12,886
Australia	951	-	-	2,085	3,036
Belgium-Luxembourg	738	237	353	837	2,165
Brazil	9,885	4,101	3,819	2,483	20,288
Canada	417	912	436	671	2,436
Denmark	336	520	521	196	1,573
Finland	635	330	-	-	965
France	21,531	13,643	11,199	13,932	60,305
Germany	32,586	19,262	11,290	14,214	77,352
Greece	140	-	-	-	140
India	4,910	2,014	671	7,963	15,558
Italy	20,052	15,159	11,388	16,448	63,047
Japan	11,053	24,141	13,623	12,022	60,839
Netherlands	4,176	1,651	868	2,407	9,102
Norway	672	224	952	1,092	2,940
Sweden	1,745	671	952	1,118	4,486
Switzerland	2,315	2,044	1,201	1,006	6,566
Taiwan	411	110	88	22	631
United Arab Republic	-	728	336	448	1,512
United Kingdom	32,328	14,434	11,190	18,418	76,370
Yugoslavia	4,810	3,151	1,471	-	9,432
Other Countries	154	140	51	279	624
TOTAL EXPORTS (Crude & Refined)	157,084	106,812	72,849	99,986	436,731

TABLE VIII

STOCKS OF REFINED COPPER REPORTED BY
U. S. B. M. AND COPPER INSTITUTE *

STOCKS END OF PERIOD	IN U. S. A.		OUTSIDE U. S. A.
	U.S.B.M.	Copper Institute	Copper Institute
Year 1952	26,000	58,858	130,103
Year 1953	49,000	89,193	280,530
Year 1954	25,000	47,108	181,529
Year 1955	34,000	61,554	159,777
Year 1956	78,000	120,645	233,775
Year 1957	109,000	181,024	277,316
Year 1958	48,000	80,722	178,152
Year 1959	18,000	64,763	228,243
Year 1960	98,000	139,272	288,510
Year 1961	49,000	79,755	332,479

* Inventory data of the Bureau of Mines and Copper Institute always differ owing to somewhat different bases. After Jan. 1, 1947, differences were due chiefly to the method of handling metal in process of refining (included as "refined" by Copper Institute and as "unrefined" by the U.S.B.M.), and to other minor variations in interpretation until May, 1951. Then the Institute's inventory data began to include tonnages delivered to U.S. consumers at foreign ports. Bureau of Mines figures are on the basis of metal physically held at primary smelting and refining plants in the U.S. In the Bureau's classification cathodes to be used chiefly for casting into shapes are considered stocks in process and not refined stocks.

TABLE IX

STOCKS OF REFINED COPPER, BLISTER, AND MATERIALS IN PROCESS
REPORTED BY UNITED STATES BUREAU OF MINES
IN SHORT TONS

END OF PERIOD	REFINED	BLISTER & MATERIALS IN PROCESS OF REFINING ^{1/}	TOTAL
Year 1952	26,000	185,000	211,000
Year 1953	49,000	223,000	272,000
Year 1954	25,000	189,000	214,000
Year 1955	34,000	201,000	235,000
Year 1956	78,000	261,000	339,000
Year 1957	109,000	274,000	383,000
Year 1958	48,000	257,000	305,000
Year 1959	18,000	253,000	271,000
Year 1960	98,000	261,000	359,000
Year 1961	49,000	236,000	285,000

^{1/} Includes copper in transit from smelter in the U. S. to refineries therein.

TABLE X

REFINED COPPER CONSUMED IN U. S. 1958-1961
BY CLASSES OF CONSUMERS

Source: U.S.B.M.

Unit: Short Tons

Class of consumer	Cathodes	Wire bars	Ingots and ingot bars	Cakes and slabs	Billets	Other	Total
1958							
Wire mills	4,394	723,450	11,464	.....	.....	962	740,270
Brass mills	91,192	47,354	74,098	116,659	150,160	47	479,510
Chemical plants ..	.....	.....	407	.....	.....	490	897
Secondary smelters	4,080	.....	2,485	219	.....	398	7,182
Foundries	3,285	413	9,731	15	201	238	13,883
Miscellaneous 1/..	779	40	1,012	111	501	6,492	8,935
Total	103,730	771,257	99,197	117,004	150,862	8,627	1,250,677
1959							
Wire mills	6,432	817,030	11,790	.....	.....	925	836,177
Brass mills	86,648	64,277	116,190	146,852	170,074	59	584,100
Chemical plants ..	.....	.....	310	.....	.....	484	794
Secondary smelters	5,320	.....	2,079	246	.....	466	8,111
Foundries	4,877	218	11,465	17	216	795	17,588
Miscellaneous 1/..	1,298	4	4,064	6	295	10,594	16,261
Total	104,575	881,529	145,898	147,121	170,585	13,323	1,463,031
1960							
Wire mills	3,928	810,570	13,450	.....	.....	875	828,823
Brass mills	74,993	64,277	80,247	137,667	144,725	52	486,460
Chemical plants ..	.....	.....	465	.....	.....	571	1,036
Secondary smelters	5,939	.....	1,913	177	.....	177	8,206
Foundries	4,644	92	10,224	26	275	900	16,161
Miscellaneous 1/..	1,220	5	2,328	6	558	5,093	9,210
Total	90,724	859,443	108,627	137,876	145,558	7,668	1,349,896
1961							
Wire mills	604	812,065	10,356	.....	.....	774	823,799
Brass mills	119,172	42,391	95,943	152,876	189,333	50	599,765
Chemical plants ..	.....	.....	720	.....	.....	549	1,269
Secondary smelters	6,782	.....	2,390	172	.....	160	9,504
Foundries	6,157	92	9,186	.....	720	923	17,078
Miscellaneous 1/..	2,532	4	4,072	25	505	4,277	11,415
Total	135,247	854,552	122,667	153,073	190,558	6,733	1,462,830

1/ Includes iron and steel plants, primary smelters producing alloys other than copper, consumers of copper powder and copper shot, and miscellaneous manufacturers.

TABLE XI

U. S. PRODUCTION AND CONSUMPTION OF COPPER

Source: U.S.B.M.

YEAR	MINE PRODUCTION	SECONDARY PRODUCTION *	TOTAL	ACTUAL CONSUMPTION TOTAL	PRODUCTION AS % OF CONSUMPTION
1946	608,737	136,909	745,646	1,187,009	62.8
1947	847,563	303,092	1,150,655	1,463,294	78.6
1948	834,813	284,026	1,118,839	1,420,584	78.8
1949	752,750	250,089	1,002,839	1,129,686	88.8
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
Totals 1946-53	6,733,343	1,838,041	8,571,384	11,015,819	
8-Yr.Avg.	841,668	229,755	1,071,423	1,376,978	77.8
1954	835,472	212,241	1,047,713	1,254,729	83.5
1955	998,570	246,928	1,245,498	1,502,004	82.9
1956	1,104,156	273,060	1,377,216	1,521,389	90.5
1957	1,086,141	248,015	1,334,156	1,347,815	99.0
1958	979,329	255,121	1,234,450	1,250,677	98.7
1959	824,846	261,588	1,086,434	1,463,031	74.3
1960	1,080,169	300,259	1,380,428	1,349,896	102.3
1961	1,165,155	279,511	1,444,666	1,462,830	98.8
Totals 1954-61	8,073,862	2,076,723	10,150,561	11,152,371	
8-Yr.Avg.	1,009,233	259,590	1,268,820	1,394,046	91.0

* Unalloyed copper

Arizona Department of Mineral Resources

August, 1962

TABLE XII

ESTIMATED ANNUAL COPPER PRODUCTIVE CAPACITY
ARIZONA, UNITED STATES, OTHER FREE COUNTRIES, COMMUNIST COUNTRIES

- 1961 -

Based on Continuous Full Operation - 350 Days Per Year - - End of 1961

ARIZONA:	Tons Copper	
Morenci	140,000	
New Cornelia	72,000	
Copper Queen	35,000	
Lavender Pit	38,000	
	<u>285,000</u>	
Ray	72,000	
Miami - Copper Cities	35,000	
Inspiration	47,000	
San Manuel	82,000	
Magma	24,000	
Silver Bell	20,000	
Pima	18,000	
Bagdad	12,000	
Duval	30,000	
Mission	45,000	
Miscellaneous	30,000	
Sub-Total - Arizona		<u>700,000</u>
<u>OTHER STATES:</u>		
Utah (chief mine-Utah Copper)	225,000	
Montana (chief mine - Butte)	130,000	
Nevada (chief mine - Ely & Yerington)	95,000	
New Mexico (chief mine - Chino)	100,000	
Michigan (chief mines-White Pine & Cal. & Hecla)... ..	80,000	
Miscellaneous	70,000	
Sub-Total - Other States		<u>700,000</u>
GRAND TOTAL UNITED STATES		<u>1,400,000</u>
<u>OTHER FREE COUNTRIES:</u>		
Canada	500,000	
Chile	650,000	
Peru	205,000	
Western Europe	140,000	
Asia	240,000	
Africa	1,100,000	
Australia	100,000	
Other Countries	65,000	
Sub-Total - Free Countries Other Than U.S.		<u>3,000,000</u>
GRAND TOTAL - All Free Countries		<u>4,400,000</u>
COMMUNIST COUNTRIES		<u>800,000</u>
GRAND TOTAL - WORLD		<u>5,200,000</u>

TABLE XIII

COPPER MINING EMPLOYMENT, WAGES AND HOURS IN U. S. AND ARIZONA

Source: "Employment and Earnings", U.S. Dept. of Labor.

U.S.B.M. Mineral Yearbooks, "Arizona's Current Employment Development"
Arizona Employment Security Commission.

	"A" Number Of All Employees		"B" Weekly Earnings		"C" Weekly Hours		"D" Hourly Earnings	
	ARIZONA	U.S.	ARIZONA	U.S.	ARIZONA	U.S.	ARIZONA	U.S.
Base Period: 1947-49 Avg.	10,700	27,100	\$ 64.20	\$ 63.11	44.83	44.10	\$ 1.432	\$ 1.431
Last Three Years:								
1959	11,100	22,400	\$108.15	\$106.25	42.8	42.5	\$ 2.526	\$ 2.50
1960	12,733	29,600	116.83	114.75	43.7	43.3	2.674	2.65
1961	13,117	29,000	126.29	119.03	44.8	43.6	2.817	2.73
1959-61 Avg.	12,317	27,000	\$117.59	\$113.93	43.84	43.19	\$ 2.682	\$ 2.638

	"E" Annual Man-Hours		"F" Annual Earnings		Annual Earnings Per Man	
	"A" x "C" x 52		"E" x "D"		"F" ÷ "A"	
	ARIZONA	U. S.	ARIZONA	U. S.	ARIZONA	U. S.
Base Period: 1947-49 Avg.	24,943,412	62,145,720	\$35,718,966	\$ 88,930,525	\$3,338	\$ 3,282
Last Three Years:						
1959	24,704,160	49,504,000	\$62,402,708	\$123,760,000	\$5,622	\$ 5,525
1960	28,934,469	66,647,360	77,370,770	176,615,504	6,076	5,967
1961	30,557,363	65,748,800	86,080,092	179,494,224	6,562	6,189
1959-61 Avg.	28,078,819	60,638,760	\$75,307,393	\$159,965,049	\$6,114	\$ 5,925

Continued -

TABLE XIII (Cont'd)

	"G" Tons Copper Ores		"H" Pounds Equiv. * Copper Produced From Copper Ores	
	ARIZONA	U. S.	ARIZONA	U. S.
Base Period: 1947-49 Avg.	38,082,754	82,875,491	748,056,267	1,625,975,640
Last Three Years:				
1959	53,121,545	103,715,843	821,777,000	1,594,926,200
1960	66,032,439	134,994,082	1,016,449,300	2,056,147,800
1961	71,918,991	142,721,798	1,121,030,000	2,239,636,000
1959-61 Avg.	63,691,000	127,144,000	986,419,000	1,963,570,000

* Includes value of gold and silver recovered from copper ores, converted into pounds copper at average copper price.

	Tons Copper Ore Produced Per Man-Hour "G" ÷ "E"		Lbs. Equiv. Copper Produced Per Man-Hour "H" ÷ "E"		Earnings Per Man-Hour "D"	
	ARIZONA	U.S.	ARIZONA	U.S.	ARIZONA	U.S.
Base Period: 1947-49 Avg.	1.5268	1.3336	29,9901	26.1639	\$ 1.432	\$ 1.431
Last Three Years: 1959-61 Avg.	2.2683	2.0967	35.1302	32.3812	\$ 2.682	\$ 2.638
% Incr. in 12 Yrs. Per Year	48.57% 4.05%	57.22% 4.77%	17.14% 1.43%	23.76% 1.98%	87.30% 7.28%	84.35% 7.03%

TABLE XIV

SUMMARY OF ESTIMATED* COPPER MINING EMPLOYMENT, WEEKLY EARNINGS,
WEEKLY HOURS, HOURLY EARNINGS, IN ARIZONA AND UNITED STATES,
BY YEARS, 1947 TO 1961 INCLUSIVE

Source: "Employment and Earnings" - U. S. Dept. of Labor.
"Arizona's Current Employment Developments" -
Arizona Employment Security Commission.

	ALL EMPLOYEES		WEEKLY EARNINGS		WEEKLY HOURS		HOURLY EARNINGS	
	Arizona	U.S.	Arizona	U.S.	Arizona	U.S.	Arizona	U.S.
1947	10,700	25,700	\$ 59.40	\$ 59.27	45.0	44.8	\$ 1.32	\$ 1.32
1948	10,900	27,800	65.99	65.81	45.2	45.2	1.46	1.46
1949	10,500	27,300	66.98	63.96	44.3	42.3	1.512	1.512
Avg.1947-1949	10,700	27,100	\$ 64.20	\$ 63.11	44.83	44.1	\$ 1.432	\$ 1.431
1950	9,500	25,800	\$ 75.80	\$ 72.05	46.5	45.0	\$ 1.63	\$ 1.601
1951	10,100	25,900	83.01	78.37	47.7	46.1	1.74	1.70
1952	10,700	26,500	90.31	85.73	47.06	45.6	1.92	1.88
1953	11,400	28,600	96.03	91.60	46.73	45.8	2.055	2.00
1954	11,900	27,400	96.60	87.33	45.31	42.6	2.132	2.05
1955	11,800	27,200	104.90	95.70	47.0	44.1	2.232	2.17
1956	13,300	34,400	112.07	100.95	47.1	43.7	2.377	2.31
1957	14,000	32,500	106.22	98.23	43.8	41.1	2.425	2.39
1958	13,500	28,400	95.40	94.62	39.8	39.1	2.399	2.42
1959	11,100	22,400	108.15	106.25	42.8	42.5	2.526	2.50
1960	12,733	29,600	116.83	114.75	43.69	43.3	2.674	2.65
1961	13,117	27,000	126.29	119.03	44.8	43.6	2.817	2.73

* These estimates include all full and part-time wage and salary workers who worked or received pay during the pay period ending nearest the 15th of the month.

TABLE XV

UNITED STATES COPPER MINING - OUTPUT IN TONS COPPER ORE,
VALUE OF COPPER, GOLD, SILVER PRODUCED

Source: U. S. Bureau of Mines

	Tons Copper Ore Annual Rate	Gold Ounces & Value	Silver Ounces & Value	Copper Pounds & Value	Lbs. Cu Recov. Per Ton & Copper Price	Value of Copper, Gold & Silver	Lbs. Copper Equiv. to Total Val. Cu, Gold & Silver
1947-1949	82,875,491	479,589 \$16,785,615	7,785,382 \$7,045,770	1,511,500,640 \$ 314,664,195	18.2 lbs. 20.81¢	\$338,495,580	1,625,975,640
1950	94,585,792	583,205 \$20,412,175	8,389,913 \$7,592,871	1,691,778,098 \$ 358,656,570	17.9 lbs. 21.2¢	\$386,616,616	1,823,876,000
1951	95,494,214	564,471 \$19,756,485	8,362,150 \$7,567,746	1,709,655,673 \$ 413,736,679	17.9 lbs. 24.2¢	\$441,060,910	1,822,566,000
1952	99,947,492	572,882 \$20,050,870	8,197,888 \$7,419,089	1,695,789,296 \$ 410,381,011	17.0 lbs. 24.2¢	\$437,850,970	1,809,300,000
1953	101,064,945	617,712 \$21,619,920	9,163,964 \$8,293,387	1,712,438,757 \$ 493,182,374	16.9 lbs. 28.8¢	\$523,095,681	1,816,305,000
1954	93,654,258	502,091 \$17,573,185	8,073,017 \$7,306,080	1,547,643,795 \$ 459,650,209	16.5 lbs. 29.7¢	\$484,529,474	1,631,412,000
1955	112,549,665	581,421 \$20,349,735	11,527,224 \$10,432,138	1,871,640,306 \$ 701,865,113	16.6 lbs. 37.5¢	\$732,646,986	1,953,725,000
1956	131,775,959	579,617 \$20,286,595	11,512,013 \$10,418,372	2,049,455,804 \$ 856,672,524	15.55 lbs. 41.8¢	\$887,377,491	2,122,912,000
1957	129,715,586	562,234 \$19,678,190	11,097,267 \$10,043,027	2,006,037,881 \$ 593,787,218	15.5 lbs. 29.6¢	\$623,508,435	2,106,447,000
1958	114,824,468	464,051 \$16,241,785	9,182,070 \$ 8,309,773	1,819,464,806 \$ 469,421,918	15.8 lbs. 25.8¢	\$493,973,476	1,914,626,000
1959	103,715,843	367,455 \$12,860,925	6,838,927 \$ 6,189,229	1,533,867,852 \$ 478,566,785	14.8 lbs. 31.2¢	\$497,616,939	1,594,926,200
1960	134,994,082	539,249 \$18,873,715	9,469,133 \$ 8,569,565	1,970,387,781 \$ 630,524,096	14.6 lbs. 32.0¢	\$657,967,376	2,056,147,800
1961	142,721,798	532,215 \$18,627,525	10,385,661 \$ 9,601,544	2,145,224,433 \$ 641,422,000	15.0 lbs. 29.9¢	\$669,651,000	2,239,636,000



MINERAL INDUSTRY SURVEYS

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF MINES

STEWART L. UDALL, Secretary

MARLING J. ANKENY, Director

Region III - Robert W. Geehan, Regional Director

224 New Customhouse
Denver 2, Colorado

Area Report III-140

THE MINERAL INDUSTRY OF ARIZONA, 1961

Arizona led the Nation in copper production, according to the Bureau of Mines, United States Department of the Interior, with an output of 587,000 short tons or 50 percent of the United States total. Valued at \$352 million, copper accounted for 81 percent of the total value of all minerals produced in the State. Output of 19 of the 32 mineral commodities produced in Arizona increased in value. Copper, sand and gravel, and cement output showed the greatest growth.

Total value of Arizona's mineral production in 1961 was \$433 million, an increase of \$17 million or 4 percent over that reported for 1960 and was the highest figure reported since 1956. Increases of \$6.4 million and \$10.5 million in the value of copper and sand and gravel production respectively, were primarily responsible for this growth. Of the total value, metals accounted for 88 percent; nonmetals, 11 percent; and mineral fuels, less than 1 percent.

Quantity and value of all metals production--with the exception of lead, manganese, tungsten, uranium, vanadium, and zinc--increased during the year. The rise in output of copper and associated byproduct metals, molybdenum, silver, and gold, accounted for most of the increase. A strike called by the International Association of Machinists idled the Inspiration mine from September 27 through October 22. Loss of production resulting from the strike was more than offset by the output from the Mission Unit placed in operation during the report period.

Sand and gravel output ranked second in value, accounting for 6 percent of Arizona's total mineral production value and for 50 percent of the value of all nonmetals (primarily sand and gravel, cement, stone, lime, pumice) produced.

No Office of Mineral Exploration (OME) contracts were executed in Arizona during 1961. The Federal Bureau of Land Management ruled that the 47 Association placer claims in the Casas Adobes area near Tucson did not have a valid mineral discovery.

An act providing for prospecting permits and mineral leases on State lands in Arizona became effective March 15.

Prepared by L. P. Larson, Mining Engineer, under the supervision of William H. Kerns, Project Coordinator, Division of Mineral Resources, Region III, in cooperation with the Arizona Bureau of Mines, for release August 24, 1962.

TABLE 1.--Mineral production in Arizona^{1/}

Mineral	1960		1961	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate-----short tons, gross weight--	(2/)	(2/)	8	\$4
Clays ^{3/} -----thousand short tons--	173	\$260	165	240
Coal-----do-----	6	58	-----	-----
Copper (recoverable content of ores, etc.)--short tons--	538,605	345,784	587,053	352,232
Gem stones-----	(4/)	120	(4/)	119
Gold (recoverable content of ores, etc.)---troy ounces--	143,064	5,007	145,959	5,109
Iron ore (usable)-----long tons, gross weight--	-----	-----	246	(2/)
Lead (recoverable content of ores, etc.)----short tons--	8,495	1,988	5,937	1,223
Lime-----thousand short tons--	148	2,430	167	2,686
Manganese ore and concentrate (35 percent or more Mn) short tons, gross weight--	1,626	40	(2/)	(2/)
Manganiferous ore and concentrate (5 to 35 percent Mn) short tons, gross weight--	8,677	190	-----	-----
Mercury-----76-pound flasks--	(2/)	(2/)	148	29
Molybdenum (content of concentrate)----thousand pounds--	4,359	5,211	4,878	6,232
Petroleum (crude)-----thousand 42-gallon barrels--	73	(2/)	5/67	(2/)
Pumice-----thousand short tons--	703	1,164	745	1,893
Sand and gravel-----do-----	14,490	14,235	21,953	24,706
Silver (recoverable content of ores, etc.) thousand troy ounces--	4,775	4,322	5,120	4,733
Stone-----thousand short tons--	4,249	5,107	3,582	4,626
Uranium ore-----short tons--	283,684	6,219	228,225	4,965
Zinc (recoverable content of ores, etc.)-----do-----	35,811	9,239	29,585	6,804
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite and fire clay [1961]), diatomite (1961), feldspar, gypsum, helium (1961), mica (scrap), perlite, pyrites, tungsten concentrate (1960), vanadium, and values indicated by footnote 2---	-----	6/15,851	-----	18,910
Total Arizona ^{7/} -----	-----	6/415,512	-----	432,614

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

^{2/} Figure withheld to avoid disclosing individual company confidential data.

^{3/} Excludes bentonite and fire clay (1961); included with "Value of items that cannot be disclosed."

^{4/} Weight not recorded.

^{5/} Preliminary figure.

^{6/} Revised figure.

^{7/} Total adjusted to eliminate duplicating value of raw materials used in manufacturing cement and lime.

TABLE 2.--Ore mined, waste and leach material removed, and total copper production at principal copper open-pit and underground mines in Arizona

(Short tons)

Mine	Ore mined		Waste and leach material removed		Total copper produced from all sources ^{1/}	
	1960	1961	1960	1961	1960	1961
Open pit:						
Morenci-----	14,500,000	16,286,000	21,200,000	27,174,000	105,640	111,443
New Cornelia-----	9,066,000	9,358,000	14,700,000	14,692,000	66,693	70,334
Ray-----	6,526,814	7,428,104	2/14,467,527	2/15,491,623	58,799	64,170
Lavender-----	4,245,000	4,928,000	11,572,000	13,647,000	33,248	39,585
Inspiration-----	5,314,770	4,847,164	4,105,835	3,447,947	40,400	39,165
Esperanza ^{2/} -----	4,245,762	4,188,775	9,648,961	-----	(3/)	(3/)
Silver Bell ^{2/} -----	2,723,200	2,686,800	1,788,470	978,670	(3/)	(3/)
Copper Cities-----	2/3,058,372	2/3,137,253	2/1,666,149	2/1,562,927	16,551	17,336
Pima-----	1,327,473	1,398,367	2 4/4,602,016	2 4/5,361,053	(3/)	(3/)
Mission Unit ^{2/} -----	-----	2,198,585	29,669,400	23,570,700	-----	(3/)
Bagdad-----	2/1,868,668	2/1,807,260	2/6,006,118	2/7,174,630	5/11,931	5/10,970
Underground:						
San Manuel-----	12,261,220	12,529,243	-----	-----	81,724	82,612
Copper Queen-----	509,700	595,000	-----	-----	25,575	30,398
Magma-----	386,636	410,958	-----	-----	18,917	20,761
Miami-----	(6/)	(6/)	-----	-----	9,390	9,429
Palo Verde-----	6,852	158,546	-----	-----	(3/)	(3/)

1/ Includes copper recovered from leaching of material in place and in dumps.

2/ Mining World Catalog, Survey & Directory, Apr. 25, 1962, p. 95.

3/ Figure withheld to avoid disclosing company confidential data.

4/ Cubic yards.

5/ Gross metal in concentrate shipped.

6/ All production from in-place leaching.

Source: Company published annual reports except where otherwise specified.

METALS

The Nation's copper industry opened the year on a pessimistic note with domestic copper consumption at a low level as the result of the recession in the durable goods sector of the economy. During the second quarter demand for copper improved sharply, and by the end of the year the copper industry was producing at near capacity. Arizona copper output was 9 percent more than that of 1960 although plants were not operated at full capacity. Copper represented 92 percent of the value of metals and 81 percent of the value of all minerals produced in the State.

The five leading copper operations furnished 398,542 tons or 68 percent of the copper output, and the top 15 accounted for 576,827 tons or 98 percent. Phelps Dodge Corp. had three of the five largest producing operations and San Manuel Copper Corp. and Ray Mines Division, Kennecott Copper Corp., each had one.

During the year, Kennecott Copper Corp. intensified research and development on leaching copper from mine waste. As a result of the joint efforts of research, engineering, and operating personnel, the amount of copper recovered by leaching was increased. Methods to produce iron for use in precipitating copper from solution were being developed, and procedures to improve iron utilization were under study. These and other programs were directed toward increasing the amount of copper recovered by leaching. Pilot-plant studies utilizing oxygen in smelting concentrates were continued during 1961, and data were processed and evaluated. Investigations and pilot-plant operations of electrolytic tank-house slimes processing, seeking to improve byproduct metal recovery and lower processing costs, were well advanced. The company also completed the 800-foot development shaft at its Safford property.

Bear Creek Mining Co., exploration subsidiary of Kennecott Copper Corp., prospected by diamond drill in the Sierritas-Twin Buttes (Pima County), Copper Creek (Pinal County), and Courtland-Gleeson (Cochise County) area.

Inspiration Consolidated Copper Co. completed the 1,793-foot McDonald production shaft at the Christmas mine, 10 miles north of Winkelman in April. In addition, 7,281 feet of drifts, raises, and miscellaneous excavation were driven. Working conditions in the mine were greatly improved with the completion of the No. 6 ventilation shaft to the 1,600-foot level and the installation of equipment with additional pumping facilities. Construction of facilities for crushing, conveying, and concentrating ore was nearly completed. Tailings dams were laid out and initial berms constructed. Installation of equipment required for transporting concentrates at the new plant to the Inspiration smelter continued. Underground work was concentrated on preparing the property for production.

The Inspiration Consolidated Copper Co. disclosed that the large tonnage of low-grade material north of Live Oak pit had been augmented by development drilling in the eastern section of the area. According to the company report, if drilling in the remaining part of this section confirms expectations, approximately 24 million tons of ore containing 0.62 percent copper would be available, in addition to the higher grade reserves in the Live Oak and

Thorton pits. Tentative plans call for mining this ore, which will have a stripping ratio of less than 2 tons of waste to 1 ton of ore, by development of another open pit to be known as the Red Hill mine.

Phelps Dodge Corp. exercised options to purchase 299 unpatented mining claims near Safford. The reported large low-grade deposit within the area covered by the claims is not expected to be developed for many years. Total copper production by the company from three operations in Arizona in 1961 was 253,000 tons, an increase of 19,000 tons over that of 1960 and the third largest production in the company history.

A new process developed at the Douglas smelter by the Phelps Dodge Corp. for removing oxygen from copper in the anode furnace by using reformed natural gas instead of wood poles also was installed at Morenci and Ajo smelters. At Morenci, large-scale metallurgical testing work was performed during the year on two separate processes for recovering small amounts of copper present in oxide form in the sulfide ores treated at the concentrator. Tests on one of the processes were discontinued, pending further laboratory study.

Duval Sulphur & Potash Co. continued exploratory drilling at its Mineral Park porphyry copper deposit located near Kingman. The work was designed to further delineate areas of proved and potential mineralization and appraise the commercial possibilities of the property. Near the end of the year close pattern drilling and underground development work were started. This work was to provide detailed information required for developing, stripping, and mining the mineral deposit. The underground development work was intended to verify drill-hole results, provide material for metallurgical testing, and determine the continuity of the deposit. Mineral rights to the property were held by the company under patented and leased mining claims. Reportedly, the deposit is a quartz monzonite stock, mineralized with pyrite and chalcopyrite, with shear zones showing extensive copper mineralization.

Duval Sulphur & Potash Co. started installing copper leach-precipitation facilities to produce copper from several mine dumps at the Esperanza mine. The conventionally designed leaching and precipitation facilities were scheduled for completion early in 1962. According to the company annual report, development drilling of outlying areas west of the present pit of the Esperanza mine disclosed the presence of substantial copper-molybdenum ore reserves exceeding the total ore mined to date at Esperanza. Mineralization in this area is similar to that of the main Esperanza ore body. The additional ore, when developed, will be processed at the Esperanza mill.

American Smelting and Refining Co. (Asarco) modernized its Hayden smelter in preparation for treating copper concentrates scheduled from the Mission operation in the Twin Buttes district. Capacity of the powerplant was increased and new dust collection equipment installed. The Mission mill, designed for a daily capacity of 15,000 tons of ore, was started in August. According to the company annual report, rated capacity was reached during September and continued throughout the rest of the year. The company

expected that during the early operations the grade of ore mined at Mission would be somewhat lower than the average grade of the ore body. Depth of gravel and rock overburden was approximately 200 feet. Before operations were started, 46.4 million tons of material was removed from the pit, of which amount 1.2 million tons was ore stockpiled for future treatment. Completed about 6 months ahead of schedule, the program cost just over \$33 million, well below the estimated \$43.5 million. Copper production from concentrates to be produced will approximate 45,000 tons per year.

Proved ore reserves at the Pima mine were estimated at 7.2 million tons, containing 1.51 percent copper, according to the Cyprus Mines Corp. annual report. These reserves were in addition to 1.8 million tons of the adjacent Banner Mining Co. ore to be mined and treated by Pima under a custom-mining-and-milling agreement. Pima Board of Directors approved plans for an expansion program to increase the daily mining rate and milling capacity from 3,800 tons to 7,000 tons. These improvements will permit the company to mine large low-grade ore reserves lying east and northeast of the present pit. Development of these reserves will extend the life of the mine for many years, according to the company.

Magma Copper Co. acquired from the Belmont Copper Mining Co. 12 patented and 112 unpatented mining claims, contiguous to and south of its Magma property at Superior. The claims, together with 50 contiguous claims optioned to Magma in 1958 by Queen Creek Copper Co., cover 3.5 square miles.

On April 26 Bagdad Copper Corp. produced the first cement copper at its \$2 million acid-leach-precipitation plant adjacent to the company open-pit copper mine at Bagdad, Yavapai County. Oxide stockpiles were irrigated with dilute acid, and the solution was pumped to launders where de-finned cans precipitated cement copper. According to the company report, problems encountered during the year in pumping and drying cement copper after it was precipitated reduced recovered values below expectations. Copper recovered per gallon of solution was less than one-half the anticipated amount. Production at the end of the year was at a rate of 10 to 15 percent of the expected 20 tons per day. The sulfuric acid plant, the largest section of the Bagdad leaching plant, went on stream April 19.

The Palo Verde shaft was completed to a depth of 1,028 feet in November 1961, following a delay of about 1 year caused by a heavy inflow of water encountered at the 960-foot depth in October 1960. Banner Mining Co. stated in its annual report to stockholders that exploration on a group of State-leased claims in the vicinity of its Palo Verde mine increased the indicated ore reserves held by the company in the immediate area to approximately 64 million tons. This amount represented an increase of approximately 10 percent over reserves held in 1960. Although considerable drilling was necessary for complete evaluation of the deposit, plans were made to develop this property. Other exploratory work conducted by the company included examination in the Helvetia district and in the Twin Buttes area.

Arkota Steel Co. dedicated its new \$1-million steel plant near Coolidge in December. The company utilized the J. D. Madaras reduction process to produce high-grade iron from magnetite sands. Raw material for

mill reportedly to reduce milling costs. Industrial Uranium Corp. reported discovering a large uranium ore body at its South Sunlight mine in Monument Valley.

Vanadium was recovered from uranium ores produced in Apache, Coconino, and Navajo Counties at vanadium recovery units operated by Climax Uranium Co., Climax Division, American Metal Climax, Inc., at Grand Junction, Colo.; Vanadium Corporation of America (VCA) at Durango, Colo.; and Kerr-McGee Oil Industries, Inc., at Shiprock, N. Mex. The quantity of vanadium recovered was slightly below that of 1960.

The Iron King mine operated by Shattuck Denn Mining Corp. was the State's largest producer of zinc, followed by the Old Dick (Cyprus Mines Corp.), Johnson Camp (McFarland & Hullinger), Atlas (B. S. & K. Mining Co.), and the Flux (Nash & McFarland). Cumulatively, these mines accounted for 97 percent of the State output of zinc.

Exploration and development of the mineralized zone near and parallel to the main ore-vein system in the Iron King mine was continued by the Shattuck Denn Mining Corp. The company obtained the right to explore, develop, and mine the area north of and adjoining the Iron King mine. Exploration in this area was to be conducted from the lower mine levels. Metallurgical research by the company included developing new products utilizing the iron and sulfur content of mill tailings. One product, "Superferrite," and agricultural soil supplement, was developed. The new product was to be produced at a pilot plant constructed to test the process commercially.

NONMETALS

In July, Phoenix Cement Co. Division, American Cement Corp., completed construction of the third 12- by 10- by 350-foot kiln at its Clarkdale plant. The new kiln, which increased the capacity of the plant by 800,000 barrels to 2.6 million barrels, was primarily responsible for a 26-percent rise in cement output in Arizona during the year. Also in July, the company delivered the millionth barrel of cement to the Glen Canyon dam construction site, representing the completion of the first one-third of its contract.

Gypsum was produced at three mines in Arizona, two in Pinal County and one in Yavapai County. Arizona Gypsum Corp. operated two of the properties, one near Winkelman, Pinal County, and one near Camp Verde in Yavapai County. The Camp Verde property was acquired by merger with the Verde Gypsum Co. in 1960. Output from the two properties was sold uncalcined for cement retarder and for agricultural purposes. National Gypsum Co. operated a mine near Winkelman and calcined the crude gypsum for use in manufacturing wallboard and lath at the company-owned plant in Phoenix. No production was reported for mines previously operated by Garcia & Peters Gypsum Co.

Concentration of metallic ores accounted for most of the lime sold or used in the State. Requirements varied from 6 to 10 pounds per ton of mill feed, depending on the oxidation of the low-grade copper ore. A small quantity was used in construction and agriculture. About 10 percent of the total quantity of lime produced was shipped to California, New Mexico, and Mexico.

the plant was to come from a magnetite-bearing alluvial deposit north of Tucson. The sands were to be upgraded to 50-percent iron by magnetic separation.

Exploration for iron and other minerals on 120,200 acres, 188 square miles of the northwestern section of the Fort Apache Indian Reservation, by The Colorado Fuel and Iron Corp. proceeded on schedule. A number of access roads were completed. Detailed mapping of some areas was in progress. The company reported that diamond drilling penetrated through the ore horizon in two places.

Ray Mines Division, Kennecott Copper Corp., produced sinter (sponge iron) and sulfuric acid from pyrite recovered as a byproduct from the Hayden mill and from pyrite purchased at Magma. Sulfur content of the pyrite produced averaged 45.1 percent. The finely divided (minus 35-mesh) sponge iron and the sulfuric acid were used in the LPF (leach-precipitation-flotation) process employed at Hayden copper ore concentrator.

Phelps Dodge Corp. completed a 25-ton-per-day sponge iron plant at the Douglas smelter and started operation during the latter part of the year. The sponge iron made from iron oxides produced during the smelting process was expected to be a more economical precipitant for the copper than the purchased de-tinned cans used in leaching at Bisbee.

Thunderbird Metallurgical, Inc., recovered manganese concentrates at the Ambrosia mill near Aguila, using Humphrey Spirals and alluviators (hydraulic sorting columns) to treat jig tailings. Four hundred to five hundred tons of ore was handled daily. Heads contained 5 to 8 percent manganese; the concentrate averaged 41 percent. The concentrates were shipped to Henderson, Nev., for conversion to electrolytic manganese dioxide; and to Mexican Hat, Utah, for use as an oxidant in processing uranium ore. Century Mining Co. was reported to have a manganese mill under construction 2 miles southwest of Bouse to treat ores from the Black Mule East and Black Mule West mines.

Molybdenum output, all recovered as a byproduct in milling copper ore, increased during the year, because production was increased by several of the State's leading copper producers. The entrance in June of the D.M.B.D. Mining Co., Inc., into the industry did not materially affect the change in output. The substantial price increase posted for molybdenum during June was mainly responsible for the 19.6-percent increase in the value of shipments, as the tonnage shipped increased by only 11.9 percent during the corresponding period. Major production of molybdenum came from San Manuel, Esperanza, and Morenci mines.

Uranium ore was produced at 42 operations in Apache, Coconino, and Navajo Counties, compared with 64 operations in 5 counties in 1960. The ore grade approximated that produced during 1960. Principal source of the ore for the Tuba City mill operated by Rare Metals Corporation of America was the Orphan mine on the south rim of Grand Canyon National Park, operated by Western Equities, Inc., formerly Western Gold and Uranium, Inc. Rare Metals planned to add a carbonate leach circuit to its Tuba City uranium

A small quantity of scrap mica was produced by the Buckeye Mica Co. at its Buckeye mine, Maricopa County. The mica was sold mainly for use in manufacturing roofing materials; a small quantity was sold for use in certain types of paints. Los Angeles and the Pacific Coast were the main market areas.

Production and shipments of perlite from Arizona mines were lower than in 1960. Arizona Perlite Roofs, Inc., and Harborlite Corp. produced less perlite in 1961 than in 1960. The Supreme Perlite, Inc., Phoenix plant produced expanded perlite for use in building plasters. Harborlite Corp. shipped crude perlite to its own plant in California.

Arizona was the Nation's largest producer of pumice and pumicite material. This material was used principally for concrete admixtures and aggregate and for railroad ballast. Standard Gilsonite Co. (Pozzolan Division) supplied the Glen Canyon dam construction project with pumice for use as a pozzolanic admixture in the concrete. Mine production of scoria by the Superlite Builders Supply Co. Darling pit, near Flagstaff, was used as a concrete aggregate in building blocks and for other purposes. San Xavier Rock & Sand Co. continued to quarry scoria from the Douglas pit, as did Gila Cinder Co. from the Pumice No. 2 mine near Safford in Graham County. Yavapai Block Co. produced volcanic cinder from its mine in Yavapai County. Paul Zanzucchi supplied the Harenberg Block Co., Inc., with volcanic cinders from the Zanzucchi cinder pit near Flagstaff for manufacturing concrete block. The Atchison, Topeka and Santa Fe Railway Co., the largest producer of pumice or pumicite material in the State, produced volcanic cinder for railroad ballast.

Sand and gravel ranked second in value of all mineral commodities produced in Arizona during the year. Commercial output accounted for 47 percent of the total sand and gravel production; Government-and-contractor production was 53 percent. Maricopa County dominated production in the State, supplying 8.4 million tons--38 percent of the State's entire output. Coconino ranked second with 5.2 million tons. Arizona completed to full or acceptable interstate standards 224.6 miles of road plus 289.7 miles of highway improved to standards adequate for present traffic for a total of 514.3 miles open to traffic. Work in progress with interstate funds included 43.0 miles under construction and 269.1 miles in engineering or right-of-way status, for a total of 312.1 miles. On the basis of mileage completed, Arizona ranked 7th in the Nation; on construction and engineering or right-of-way, 18th.

MINERAL FUELS

Production of petroleum from wells, all located in Apache County in northeastern Arizona, totaled 67,000 barrels, 8 percent below the 1960 output. During the year, 23 wells (15 exploratory and 8 development) were completed. Exploratory drilling resulted in one oil discovery. Two of the development holes completed were successful, one for oil and one for gas. The Kaibab National Forest was opened to oil and gas exploration. As of June 12, lease applications for 400,000 acres had been filed on this area and were awaiting action by the Federal Bureau of Land Management.

TABLE XVI

ARIZONA COPPER MINING - OUTPUT IN TONS COPPER ORE,
VALUE OF COPPER, GOLD, SILVER PRODUCED

Source: U. S. Bureau of Mines

	Tons Copper Ore Annual Rate	Gold Ounces & Value	Silver Ounces & Value	Copper Pounds & Value	Lbs. Cu Recov. Per Ton & Copper Price	Value of Copper, Gold & Silver	Lbs. Copper Equiv. to Total Val. Cu, Gold & Silver
1947-1949	38,082,754	79,612 \$2,786,420	2,603,485 \$2,356,154	723,353,767 \$150,588,843	19.0 lbs/ton 20.818¢	\$155,731,417	748,056,267
1950	41,757,037	79,562 \$2,784,670	2,853,375 \$2,582,304	765,334,514 \$162,250,916	18.3 lbs/ton 21.2¢	\$167,617,890	767,000,000
1951	42,784,388	83,521 \$2,923,235	3,087,865 \$2,794,518	775,609,514 \$187,697,501	18.1 lbs/ton 24.2¢	\$193,415,254	799,236,600
1952	44,472,522	83,692 \$2,929,220	2,900,851 \$2,625,270	730,809,903 \$176,855,996	16.4 lbs/ton 24.2¢	\$182,410,486	753,762,300
1953	45,187,838	89,724 \$3,140,340	3,164,255 \$2,863,809	738,404,453 \$211,922,077	16.3 lbs/ton 28.7¢	\$217,926,226	759,324,830
1954	43,072,894	94,648 \$3,312,680	3,380,060 \$3,058,954	714,154,795 \$212,103,976	16.6 lbs/ton 29.7¢	\$218,475,610	735,608,120
1955	52,189,728	105,330 \$3,686,550	3,629,191 \$3,284,418	856,270,850 \$321,101,569	16.4 lbs/ton 37.5¢	\$328,072,537	874,860,100
1956	60,468,580	119,435 \$4,180,225	3,963,579 \$3,587,039	935,039,400 \$390,846,469	15.5 lbs/ton 41.8¢	\$398,613,733	953,621,100
1957	59,571,834	123,375 \$4,318,125	4,088,618 \$3,700,200	947,840,100 \$280,560,670	15.9 lbs/ton 29.6¢	\$288,579,000	975,720,000
1958	56,255,809	114,262 \$3,999,170	3,543,044 \$3,206,455	913,973,800 \$235,805,240	16.2 lbs/ton 25.8¢	\$243,010,865	941,903,000
1959	53,121,545	96,153 \$3,365,355	2,724,701 \$2,465,854	803,087,000 \$250,563,144	15.1 lbs/ton 31.2¢	\$256,394,353	821,777,000
1960	66,032,439	115,602 \$4,046,070	3,689,622 \$3,339,108	993,370,700 \$317,878,624	15.0 lbs/ton 32.0¢	\$325,263,802	1,016,449,300
1961	71,918,991	129,184 \$4,521,440	4,380,458 \$4,049,733	1,092,360,900 \$326,616,000	15.2 lbs/ton 29.9¢	\$335,187,173	1,121,030,000

TABLE XVII

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

1858-1961 Incl. - In Terms of Recoverable Metals

Source: U. S. B. M.

	COPPER		LEAD		ZINC	
	Short Tons	Value (thousands)	Short Tons	Value (thousands)	Short Tons	Value (thousands)
1874-1960	17,195,391	\$ 6,721,649	608,841	\$ 118,450	850,700	\$ 205,799
1961 Only	587,053	352,232	5,937	1,223	29,585	6,804
Total 1874-1961	17,782,444	\$ 7,073,881	614,778	\$ 119,673	880,285	\$ 212,603
Avg. Price		\$ 0.19890		\$ 0.09733		\$ 0.12076

	GOLD		SILVER		TOTAL VALUE
	Ounces	Value (thousands)	Ounces	Value (thousands)	
1858-1960	12,593,738	\$ 328,276	359,313,649	\$ 277,565	\$ 7,651,738,000
1961 Only	145,959	5,109	5,120,007	4,733	370,101,000+
Total 1858-1961	12,739,697	\$ 333,385	364,433,656	\$ 282,298	\$ 8,021,840,000-
Avg. Price		\$ 26.169		\$ 0.77462	

Estimated Value of Other Metals and Non-metallics Production in Arizona through 1960	\$ 382,916,000
" " " " " " " " " " " " in 1961	62,513,000
Estimated Value of Other Metals and Non-Metallics Production in Arizona through 1961	\$ 445,429,000
GRAND TOTAL ESTIMATED VALUE OF ARIZONA'S MINERAL PRODUCTION THROUGH 1961	\$ 8,467,268,000

First year of reported production: Gold & Silver-1858, Copper-1874, Lead-1894, Zinc-1905.

TABLE XVIII

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD AND ZINC IN ARIZONA IN THE YEAR 1961
BY CLASS OF ORE IN TERMS OF RECOVERABLE METALS

Source: U.S.B.M. Final Figures

Source	Number of mines ^{1/}	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold -----	16	30,450	610	4,901	336,400	6,300	8,300
Dry gold-silver -----	5	104,447	277	13,197	1,969,600	-----	-----
Dry silver -----	11	15,456	13	16,339	67,500	-----	-----
Total -----	32	150,353	900	34,437	2,373,500	6,300	8,300
Copper -----	43	71,918,991	129,184	4,380,455	1,092,360,900	1,000	449,600
Copper-zinc -----	4	156,824	95	52,431	9,044,400	5,600	19,183,400
Lead -----	6	1,250	34	6,367	3,900	148,700	9,800
Lead-zinc -----	10	260,547	14,731	627,644	634,600	11,701,200	35,095,900
Zinc -----	2	15,059	-----	654	46,600	-----	4,419,100
Total -----	64	72,352,671	144,044	5,067,551	1,102,090,400	11,856,500	59,157,800
Other "lode" material:							
Gold mill cleanup -----	(2/)	(3/)	197	113	-----	-----	-----
Gold-silver and silver tailings -----	4	29,217	599	10,241	92,000	900	-----
Copper cleanup -----	(2/)	763	6	955	198,700	-----	1,800
Copper smelter cleanup ---	(2/)	2,180	105	4,423	275,400	2,700	1,300
Copper precipitates -----	11	46,861	-----	-----	68,698,300	-----	-----
Copper tailings -----	1	1,982	-----	481	23,200	-----	-----
Lead cleanup -----	(2/)	6	-----	1	-----	4,100	-----
Lead smelter cleanup -----	(2/)	2	-----	4	-----	3,400	-----
Uranium ore -----	-----	-----	-----	1,798	354,500	100	800
Total -----	16	81,011	907	18,016	69,642,100	11,200	3,900
Total "lode" material --	100	72,584,035	145,851	5,120,004	1,174,106,000	11,874,000	59,170,000
Gravel (placer operations) --	4	-----	108	3	-----	-----	-----
Total, all sources -----	104	72,584,035	145,959	5,120,007	1,174,106,000	11,874,000	59,170,000

^{1/} Detail will not necessarily add to totals because same mines produce more than 1 class of material

^{2/} From properties not classed as mines.

^{3/} Less than 0.5 ton.

TABLE XIX

COPPER PRODUCTION RECORD OF LARGE ARIZONA COPPER MINES
YEARS 1960 AND 1961

Source: U.S.B.M. & Company Reports

MINE	1960		1961	
	Tons Copper Ore Mined	Pounds Copper Recovered	Tons Copper Ore Mined	Pounds Copper Recovered ^{2/}
PHELPS DODGE:				
Morenci	14,499,800	211,281,072	16,286,000	222,886,000
New Cornelia	9,065,600	133,385,819	9,358,000	140,668,000
Lavender Pit	4,248,400	66,496,523	4,928,000	79,170,000
Copper Queen	509,700	51,149,219	595,000	60,796,000
Sub-Total	28,323,500	462,312,633	31,167,000	503,520,000
KENNECOTT: Ray	6,526,814	117,497,684	7,428,104	128,340,000
MIAMI:				
Miami		18,930,454		19,102,143
Copper Cities	3,058,372	33,100,562	3,137,253	34,672,592
Castle Dome		5,306,988		5,397,242
Sub-Total		57,338,004	3,137,253	59,171,977
INSPIRATION	5,314,770	80,800,960	4,847,164	78,330,640
MAGMA:				
San Manuel	12,261,220	163,448,339	12,529,243	165,223,023
Superior	386,636	37,834,116	410,958	41,521,458
Sub-Total	12,647,856	201,282,455	12,940,201	206,744,481
A.S. & R. CO.:				
Silver Bell	2,718,700	45,138,255	2,686,800	45,400,000
Mission Unit	-	-	2,198,600	29,840,000
Sub-Total	2,718,700	45,138,255	4,885,400	75,240,000
PIMA MINING CO.: Pima	1,327,473	26,769,896	1,398,367	33,230,008
BAGDAD COPPER CORP.	1,823,055	23,666,978	1,766,418	21,161,047
DUVAL: Esperanza	4,245,762	50,735,060	4,188,775	48,484,343
BANNER MINING CO.:				
Palo Verde, Mineral Hill & Daisy	55,724	2,568,032 ^{1/}	158,791	6,773,538 ^{1/}
TOTALS	66,042,026	1,068,109,957	71,917,473	1,160,996,039

^{1/} Estimated 97% of copper in concentrates.^{2/} "Copper Recovered" means "Net Refined or Marketable Copper"

TABLE XX

MINERAL PRODUCTION OF LARGE AND SMALL PRODUCERS IN ARIZONA IN 1961 ^{1/}

Source: U.S.B.M. Area Report III-140

<u>LARGE COPPER PRODUCERS:</u> *		<u>PRODUCTION</u>	<u>VALUE</u>
Copper (lbs.)	1,154,222,501	\$ 346,266,750	
Gold (ozs.)	129,184	4,521,440	
Silver (ozs.)	4,380,455	4,049,293	
Molybdenum (lbs.) (content of concentrate)	4,878,000	6,232,000	
Total Value of Large Mine Production in 1961			\$ 361,069,483
<u>SMALL MINERAL PRODUCERS:</u>			
Beryllium concentrates ... short tons, gross weight	8	\$ 4,000	
Clays ^{3/}	165	240,000	
Copper (recoverable content of ores etc.)..lbs. ...	19,883,499	5,965,250	
Gem stones	(4/)	119,000	
Gold (recoverable content of ores etc.) troy ounces	16,775	587,560	
Iron ore (usable) .. Long tons, gross weight	246	(2/)	
Lead (recoverable content of ores, etc.)short tons.	5,937	1,223,000	
Lime	167,000	2,686,000	
Manganese ore and concentrate (35%+Mn)short tons ..	(2/)	(2/)	
Mercury	148	29,000	
Petroleum (crude)	(5/)	67	(2/)
Pumice	745	1,893,000	
Sand and gravel.. " " "	21,953	24,706,000	
Silver(recoverable content of ores,etc.)			
thousand troy ounces	740	683,707	
Stone	3,582	4,626,000	
Uranium ore	228,225	4,965,000	
Zinc (recoverable content of ores, etc.) short tons	29,585	6,804,000	
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite & fire clay), diatomite, feldspar, gypsum, helium, mica (scrap), perlite, pyrites, vanadium, and values indicated by footnote ^{2/}			18,910,000
Total Value of Small Mine Production ^{6/} ..			\$ 71,544,517
GRAND TOTAL VALUE OF MINERAL PRODUCTION			\$ 432,614,000
PERCENTAGE DUE TO SMALL MINES			16.54%

* Phelps Dodge, Kennecott, Inspiration, Miami, Magma (incl. San Manuel) Asarco's Silver Bell, Pima, Bagdad, Duval's Esperanza and Asarco's Mission Unit.

- ^{1/} Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
^{2/} Figure withheld to avoid disclosing individual company confidential data.
^{3/} Excludes bentonite and fire clay (1961); included with "Value of items that cannot be disclosed."
^{4/} Weight not recorded.
^{5/} Preliminary figure.
^{6/} Total adjusted to eliminate duplicating value of raw materials used in manufacturing cement and lime.

TABLE XXI

SUMMARY OF TOTAL COVERED EMPLOYMENT & WAGES IN ARIZONA COPPER MINING
1947-1961 INCLUSIVE

Source: Arizona Employment Security Commission
United States Bureau of Mines

COPPER MINING:	No. Covered Employees	Covered Wages	Average Annual Wage	Tons Copper Ores	Average Weekly Wage
1947	11,340	\$36,365,277	\$3,207	37,810,448	\$61.67
1948	11,493	41,318,524	3,595	39,072,204	69.13
1949	11,001	40,612,224	3,692	37,365,611	71.00
1950	10,181	41,994,321	4,125	41,757,273	79.33
1951	10,754	47,825,698	4,447	42,784,388	85.52
1952	11,365	54,950,235	4,835	44,472,522	93.14
1953	12,068	62,742,982	5,199	45,187,838	99.98
1954	12,502	65,518,853	5,241	43,072,894	100.79
1955	12,399	71,293,263	5,750	52,189,728	110.58
1956	14,008	83,568,996	5,966	60,468,580	114.73
1957	14,652	85,125,320	5,809	59,571,834	111.71
1958	14,100	74,726,972	5,300	56,255,809	101.93
1959	11,568	72,095,130	6,232	53,121,545	119.85
1960	13,764	90,312,848	6,562	66,032,439	126.19
1961	14,275	97,271,286	6,814	71,918,991	131.04

TABLE X XII

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

Base period 1947-49, 1959, 1960 & 1961

Arizona Covered Industry

Compiled by Department of Mineral Resources

Source: Arizona Employment Security Commission

	Average No.Of 1/ Employees	Total Wages	Average Annual Wage	Average Weekly Wage	Average No.Of 1/ Employees	Total Wages	Average Annual Wage	Average Weekly Wage
	Base Period 1947 - 1949				Year 1959			
Copper Mining Only 3/	11,278	\$ 39,432,008	\$ 3,496	\$ 67.23	11,568	\$ 72,095,130	\$ 6,232	\$119.85
All Mining & Quarrying	12,870	44,345,018	3,446	66.27	13,680	83,038,890	6,070	116.74
Smelting 2/	1,500	5,175,000	3,450	66.35	1,525	8,439,106	5,534	106.42
All Mining, Quar., & Smelting	14,370	49,520,018	3,446	66.27	15,205	91,477,996	6,016	115.69
Manufacturing (Excl.Smelting)	12,639	36,910,624	2,920	56.15	43,400	241,713,804	5,569	107.10
Construction	10,844	35,424,826	3,267	62.83	29,260	169,187,767	5,782	111.19
Transp. & Utilities(Excl.RR's)	10,530	29,948,944	2,844	54.69	18,839	97,345,413	5,167	99.37
Wholesale-Retail Trade	36,213	91,916,860	2,538	48.81	68,990	263,771,499	3,823	73.52
Services & Misc.(Incl.Agri.)	18,643	43,103,526	2,312	44.46	42,727	162,489,695	3,803	73.13
Totals and Averages	103,239	\$286,824,898	\$ 2,778	\$ 53.42	218,421	\$1,025,986,174	\$ 4,697	\$ 90.33

	Year 1960				Year 1961			
Copper Mining Only 3/	13,764	\$ 90,312,848	\$ 6,562	\$126.19	14,275	\$ 97,271,286	\$ 6,814	\$131.04
All Mining & Quarrying	15,837	102,175,093	6,452	124.08	16,178	107,813,787	6,664	128.15
Smelting 2/	1,033	5,995,780	5,804	111.62	965	5,923,749	6,139	118.05
All Mining, Quar., & Smelting	16,870	108,170,873	6,412	123.31	17,143	113,737,536	6,635	127.60
Manufacturing (Excl.Smelting)	46,470	265,799,784	5,720	110.00	48,865	289,083,011	5,916	113.77
Construction	32,174	200,203,313	6,223	119.67	31,233	209,974,317	6,723	129.30
Transp. & Utilities(Excl.RR's)	19,906	106,302,227	5,340	102.69	20,147	111,590,519	5,539	106.52
Wholesale-Retail Trade	74,423	291,911,971	3,922	75.42	77,471	309,450,570	3,994	76.81
Services & Misc.(Incl.Agri.)	47,190	187,753,626	3,979	76.52	52,451	214,534,813	4,090	78.66
Totals and Averages	237,033	\$1,160,141,794	\$ 4,894	\$ 94.12	247,300	\$1,248,370,766	\$ 5,048	\$ 97.08

1/ This number includes all covered employees on payroll, and is not restricted to production workers only, on which the average hourly and weekly earnings are reported. 2/ Smelting employment has been segregated from Manufacturing as reported by the Employment Security Commission. 3/ This number includes all copper milling employees and some copper smelting employees not reported under Manufacturing by the Employment Security Commission.

Note: Fringe benefits are not included in the total wages.