

GROSS COPPER CONTENT OF ALL ARIZONA COPPER ORES, 1946-1955
COPPER RECOVERED FROM ALL ARIZONA COPPER ORES, 1946-1955
COMPARATIVE COPPER RECOVERIES BY PERIODS FROM 1910-1955
METAL PRODUCTION OF PRINCIPAL LEAD-ZINC MINING DISTRICTS-1952-1955

Tables Compiled By The Arizona Department of Mineral Resources

August, 1956

The Arizona Department of Mineral Resources has compiled tables showing a radical drop in the pounds of copper recovered per ton of copper ore mined during the last forty-five years. Data were available showing the gross copper content of Arizona copper ores in each of the last ten years, during which the average assay of all copper ores dropped from 1.10% copper to less than one percent, and recovery dropped from about 18½ pounds per ton to less than 16½ pounds per ton. This low recovery may be contrasted with earlier periods during which recovery data were available. For example, from 1910-1919, the recovery was 48.38 lbs. per ton; from 1920-29, it was 34.18 lbs. per ton; from 1930-1939, it was 32.26 lbs. per ton; from 1941-1945, it was 21.10 lbs. per ton; and for the last ten years it was only 17.50 lbs. per ton. In terms of recoverable copper, the assays for those periods indicated a drop from 2.41% copper in the first ten year period, to 0.875% copper in the last ten-year period.

The figures show that although metallurgical extraction (considering the low grade of ore now being treated) has been improving during the last forty years, there is still room for improvement. The loss of copper into the tailings from copper flotation concentrators can be traced to the presence of oxidized copper in the ores treated. For example, straight sulphide extractions have been as high as 95%, while oxide extraction have been as low as 30 to 35%. The failure of the flotation process to recover oxidized copper, and the gradual lowering of the sulphide copper content of normal copper ores, have resulted in the big copper concentrators taking steps to leach the oxidized copper with acid, precipitating on sponge iron, and floating the precipitated copper in conjunction with the sulphide copper. This will keep Arizona copper mines in business in spite of the low-grade of the ore and the higher costs for labor and supplies.

LEAD-ZINC

Table V shows an average metal content of 2.6% lead, 6.4% zinc, 0.11 oz. gold and 3.6 oz. silver in the Big Bug District, as compared with 5.0% lead, 9.8 % zinc, 0.003 oz. gold and 4.0 oz. silver in the Harshaw District; and 2.9% copper, 5.8% zinc and 0.45 oz. silver in the Cochise (Dragoon) District. The annual ore tonnage from these districts was 197,600 tons, 50,100 tons and 76,700 tons respectively.

Arizona Department of Mineral Resources

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COPPER CONTENT OF ARIZONA'S MILLING, LEACHING AND
DIRECT SMELTING COPPER ORES
GROSS CONTENT AND RECOVERABLE CONTENT
POUNDS COPPER RECOVERED PER TON.
1946-1955 Inclusive Source U. S. B. M.

TABLE I

COPPER MILLING ORE					
	Tons Ore	Gross Lbs. Copper	% Copper	Net Lbs. Cu Recovered	% Extraction
1946	26,984,754	566,680,000	1.050	465,885,731	82.21
1947	33,494,441	701,777,060	1.048	586,856,015	83.62
1948	34,632,227	704,753,920	1.017	594,377,003	84.34
1949	33,528,676	703,488,029	1.049	587,407,347	83.50
1950	37,586,791	806,971,010	1.073	662,962,116	82.15
1951	38,545,214	803,626,242	1.042	662,877,431	82.49
1952	40,175,312	749,450,544	0.933	614,245,361	81.96
1953	40,996,882	756,211,000	0.922	621,892,697	82.24
1954	39,268,884	725,110,556	0.923	595,260,885	82.09
P. 1955	48,184,600	892,580,000	0.926	729,617,679	81.74
Totals & Avgs.	373,397,781	7,410,648,361	0.992	6,121,382,265	82.54
COPPER LEACHING ORE					
	Tons Ore	Gross Lbs. Copper	% Copper	Net Lbs. Cu Recovered	% Extraction
1946	2,969,041	66,061,962	1.113	57,061,962	86.38
1947	3,671,800	78,918,108	1.075	67,918,108	86.06
1948	3,753,197	79,834,970	1.064	69,834,970	87.47
1949	3,368,001	65,878,100	0.978	57,028,112	86.57
1950	3,755,362	75,708,100	1.008	65,843,700	86.97
1951	3,696,413	72,936,589	0.987	62,774,397	86.07
1952	3,735,773	74,075,928	0.991	65,034,778	87.79
1953	3,576,794	72,609,000	1.015	62,816,474	86.51
1954	3,127,298	62,370,884	0.997	53,812,100	86.28
P. 1955	3,363,400	64,981,000	0.966	57,043,571	87.78
Totals & Avgs.	35,017,079	713,374,641	1.019	619,168,172	86.79

P = Preliminary

Continued

TABLE I (Continued)

DIRECT SMELTING COPPER ORE					
	Tons Ore	Gross Lbs. Copper	% Copper	Net Lbs.Cu Recovered	% Extraction
1946	432,354	34,972,040	4.044	32,995,643	94.35
1947	644,207	57,832,051	4.489	54,934,237	95.00
1948	686,780	63,891,522	4.652	60,820,312	95.19
1949	468,934	41,082,098	4.380	38,694,396	94.19
1950	415,120	38,534,609	4.641	36,528,698	94.79
1951	542,761	51,744,359	4.767	49,957,686	96.55
1952	561,437	53,206,537	4.738	51,529,664	96.84
1953	614,162	55,500,000	4.554	53,695,282	96.75
1954	676,712	67,793,560	5.009	65,081,810	96.00
P.1955	700,000	66,500,000	4.750	63,338,750	95.25
Totals & Avgs.	5,742,467	531,056,776	4.624	507,576,478	95.58
ALL COPPER MILLING, LEACHING & SMELTING ORES					
	Tons Ore	Gross Lbs. Copper	% Copper	Net Lbs. Copper Recovered	Lbs.Cu Re- cov'd Per Ton Ore
1946	30,386,149	667,714,002	1.099	555,943,336	83.26
1947	37,810,448	838,527,219	1.109	709,708,360	84.64
1948	39,072,204	848,480,412	1.086	725,032,285	85.45
1949	37,365,611	810,448,227	1.084	683,129,855	84.29
1950	41,757,273	921,213,719	1.103	765,334,514	83.08
1951	42,784,388	928,307,190	1.085	775,609,514	83.55
1952	44,472,522	876,733,009	0.986	730,809,803	83.36
1953	45,187,838	884,320,000	0.978	738,404,453	83.50
1954	43,072,894	855,275,000	0.993	714,154,795	83.50
P.1955	52,248,000	1,024,061,000	0.980	850,000,000	83.00
Totals & Avgs.	414,157,327	8,655,079,778	1.045	7,248,126,915	83.74

P = Preliminary

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TABLE II

COPPER RECOVERED FROM ALL ARIZONA COPPER ORE

By Periods From 1910-1955 Inclusive			Source: U.S.B.M.
Period	Tons All Copper Ore	Lbs. Copper Recovered	Lbs. Cu Recov'd Per Ton Ore
1910-1919	102,383,727	4,952,633,753	48.38
1920-1929	178,520,237	6,101,298,433	34.18
1930-1939	110,648,703	3,568,487,430	32.26
1941-1945	158,965,869	3,353,901,033	21.10
1946-1955	414,157,327	7,248,127,015	17.50

TABLE III

COPPER ORE MINED IN ARIZONA, WITH RECOVERABLE METAL CONTENT

Years 1951 - 1955 Inclusive				Source: U. S. B. M.		
	Total Copper Ore Treated	Recoverable Metal Content			Value Gold & Silver	
		Copper		Gold	Silver	
	Tons	Pounds	Percent	Fine Ozs.	Fine Ozs.	Per Ton
1951	42,784,388	775,609,514	0.906	83,521	3,087,865	\$0.13
1952	44,472,522	730,809,903	0.822	83,692	2,900,851	0.12
1953	45,187,838	738,404,453	0.817	89,724	3,164,255	0.13
1954	43,072,894	714,154,795	0.829	94,648	3,380,060	0.15
1955 P.	52,248,000	850,000,000	0.815	105,000	3,675,000	0.13
P = Preliminary						

TABLE IV

COPPER RECOVERED FROM OTHER ORES AND MINE WATER PRECIPITATES
PROPORTION OF COPPER ORE MINED BY OPEN PIT

Years 1951-1955 Inclusive			Source: U. S. B. M.
	Ores Other Than Copper	Mine Water Precipitates	Proportion of Open-Pit Copper Ore
	Lbs. Copper Recovered	Lbs. Copper Recovered	
1951	21,958,171	34,500,255	81.3%
1952	17,144,989	43,483,108	84.3%
1953	8,210,700	40,434,847	85.6%
1954	5,698,390	36,000,815	85.5%
1955 P.	14,000,000	40,000,000	90.0%
P = Preliminary			

TABLE V
METAL PRODUCTION OF THREE PRINCIPAL LEAD-ZINC
MINING DISTRICTS IN ARIZONA

Years 1952-1955 Incl.

Source: U.S.B.M.

	Tons Ore	Tons Copper	Tons Lead	Tons Zinc	Oz. Gold	Oz. Silver	Total Value
<u>BIG BUG</u>							
1952	196,186	206	4,135	10,862	17,317	581,699	\$ 6,169,687
1953	191,163	218	4,339	10,476	17,788	591,388	4,829,476
1954	179,511	190	4,336	10,453	17,802	579,281	4,704,932
1955	223,500	210	4,560	11,180	21,525	698,200	5,649,841
TOTAL	790,360	824	17,370	42,971	74,432	2,450,568	\$21,353,936
Recoverable Metal		0.104	2.198	5.437	0.094 oz.	3.101 oz.	\$ 27.02
Content % or Oz.*							
Approx.Assay of Ore.*		0.122	2.586	6.397	0.111 oz.	3.648 oz.	
<u>HARSHAW</u>							
1952	48,290	74	1,921	3,924	155	176,778	\$ 2,122,303
1953	50,665	206	2,104	4,186	121	176,073	1,796,129
1954	50,108	155	2,135	4,193	113	170,665	1,740,629
1955	51,400	130	2,450	4,400	100	153,000	2,050,673
TOTAL	200,463	565	8,610	16,703	489	676,516	\$ 7,709,734
Recoverable Metal		0.282	4.295	8.332	0.0024 oz.	3.375 oz.	\$ 38.46
Content % or Oz.*							
Approx.Assay of Ore.*		0.332	5.053	9.802	0.0028 oz.	3.971 oz.	
<u>COCHISE (DRAGOON)</u>							
1952	77,748	1,838	-	4,266	22	26,930	\$ 2,330,812
1953	76,836	1,849	-	3,893	12	28,889	1,959,227
1954	76,880	1,947	-	3,566	15	30,857	1,947,090
1955	75,300	2,050	-	3,250	15	31,000	2,344,557
TOTAL	306,764	7,684	-	14,975	64	117,676	\$ 8,581,686
Recoverable Metal		2.505	-	4,892	0.0006 oz.	0.384 oz.	\$ 27.97
Content % or Oz.*							
Approx.Assay of Ore.*		2.947		5.755	0.0007 oz.	0.452 oz.	

* Based on 85% metal extraction.