

U.S. DEPARTMENT OF COMMERCE
DANIEL C. ROPELLO
BUREAU OF MINERAL RESOURCES
SCOTT TURNER

MINERALS YEARBOOK 1932

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UNITED STATES GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

For sale by the Superintendent of Documents, Washington, D. C.

N49758

World smelter production of copper, 1928-32, in metric tons

Country ¹	1928	1929	1930	1931	1932
North America:					
Canada ²	50,619	72,661	101,554	110,588	95,691
Mexico	46,865	58,997	64,025	43,000	32,000
United States ³	911,444	998,789	729,011	537,175	278,997
	1,014,928	1,130,447	885,190	690,763	406,688
South America:					
Chile	274,900	303,188	208,011	215,606	(⁴)
Peru	52,202	53,902	47,287	44,395	22,531
	327,102	357,150	265,298	260,001	(⁴)
Europe:					
Austria	3,424	3,895	4,076	3,235	(⁴)
Belgium ⁵	9,720	8,040	14,040	31,400	(⁴)
Czechoslovakia	1,010	1,004	1,521	1,215	(⁴)
Finland	375	235			(⁴)
France	1,142	1,010	1,207	1,000	1,000
Germany ⁶	48,500	53,600	50,200	55,500	50,000
Great Britain ⁷	21,400	22,000	18,900	16,000	(⁴)
Italy	900	539	262	731	427
Norway	788	2,400	5,149	4,352	(⁴)
Rumania	101	143	160	(⁴)	(⁴)
Russia	18,900	25,000	20,000	27,000	(⁴)
Spain	27,788	28,455	22,090	25,734	(⁴)
Sweden ⁸	3,396	4,748	5,523	2,854	(⁴)
Yugoslavia	15,086	20,675	24,463	24,351	(⁴)
	152,599	173,334	183,206	193,302	(⁴)
Asia:					
China ⁹	4,395	3,469	1,203	157	(⁴)
Chosen	607	547	580	600	(⁴)
India, British		1,061	3,022	4,134	(⁴)
Japan	68,233	75,469	79,033	76,408	70,646
	73,235	81,146	83,847	81,299	(⁴)
Africa:					
Belgian Congo	111,510	135,539	136,404	120,000	54,000
Rhodesia	6,026	5,553	6,370	9,070	98,977
Northern	110	362	1,334	538	6
Southern	8,849	9,309	7,488	10,225	9,837
Union of South Africa					
	120,495	150,703	151,590	139,833	132,830
	12,048	11,049	15,139	13,144	(⁴)
Oceania: Australia					
	1,700,000	1,904,000	1,574,000	1,378,000	910,000

¹ In addition to the countries listed, copper is smelted in Asiatic Turkey, but data of output are not available.

² Copper content of blister produced.

³ Approximate production.

⁴ Smelter output from domestic and foreign ores, exclusive of scrap. The production from domestic ores only, exclusive of scrap, was as follows: 1928, 828,210 tons; 1929, 908,479 tons; 1930, 632,451 tons; 1931, 412,063 tons; 1932, 240,757 tons.

⁵ Data not available.

⁶ Figures represent blister copper only. In addition to blister copper, Belgium reports a large output of refined copper which is not included above as it is believed produced principally from crude copper from the Belgian Congo and would, therefore, duplicate output reported under the latter country.

⁷ Exclusive of material from scrap. (Metallgesellschaft, Stnt. Zusammenstell.)

⁸ Approximate production. (Imp. Inst., London.)

⁹ Smelter output from domestic ores.

¹⁰ Less than 1 ton.

¹¹ Year ended Sept. 30.

¹² Exclusive of material from scrap.

¹³ Exports of ingots and slabs.

¹⁴ In addition to the crude copper smelted in the Belgian Congo, the following quantities were smelted in Belgium from matte and alloys produced in the Belgian Congo: 1928, 940 tons; 1929, 1,453 tons; 1930, 2,545 tons.

LEAD

By C. W. WRIGHT AND H. M. ME

Domestic production of lead in 1932 was 28 percent decrease of 154,403 tons (35 percent) from the 1931 production. In most metals, the lack of demand or consumption conditions was the principal cause of this decline. The decline in consumption of secondary pig lead—amounting to 128,000 tons—was entirely from old storage batteries—did not decrease demand for primary lead. The amount of secondary lead recovered in 1932 was 78 percent of the recovery of primary domestic lead.

The decline in consumption has been so rapid that the producers have been unable to adjust themselves to it, and this, with the reduction in the market price for lead, has been disastrous financially to even the strongest companies and has caused complete suspension of numerous important lead-producing

curtailment in output nor the reduction in price of lead from increasing to a total of 176,000 tons at the end of 1932. Equilibrium of the market requires further curtailment for a year or more, as well as improvement in general demand. It is noteworthy, however, that while domestic production of lead in 1932 was 35 percent below that of 1931, foreign production was only 12 percent in 1932.

Figure 3 shows trends in production, consumption, and prices of primary lead in the United States for 1926-1932. The following summary table includes the same data for the lead industry in the United States for 1931 and 1932. It is evident that consumption must increase further to reduce stocks on hand.

As for the advance in mining and metallurgical research on uses of lead by producing companies, the record of the past year offers virtually no

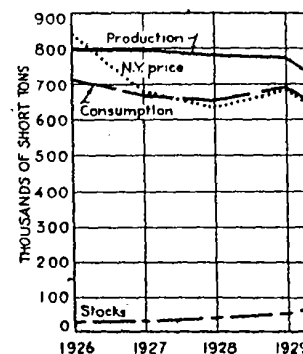


FIGURE 3.—Trends in production, consumption, and prices of primary lead in the United States for 1926-1932.

Salient statistics of the lead industry in the United States, 1931-32

	1931	1932
Production of refined primary lead:		
From domestic ores.....short tons.....	390,260	255,337
From foreign ores and base bullion.....do.....	52,504	33,024
	442,764	288,361
Recovery of secondary lead:		
As pig lead.....do.....	128,800	128,000
In alloys.....do.....	105,900	70,300
	234,700	198,300
Total production of pig lead (primary and secondary).....do.....	571,564	416,361
Imports (general):		
Lead in base bullion.....do.....	32,320	13,462
Lead in ore.....do.....	20,888	21,001
Exports of refined pig lead.....do.....	21,065	23,516
Refined primary lead available for consumption.....do.....	410,606	257,666
Estimated consumption of primary and secondary lead.....do.....	567,700	400,000
Prices per pound of refined lead at New York:		
Highest monthly average.....cents.....	4.80	3.78
Lowest monthly average.....do.....	3.79	2.73
Average for year.....do.....	4.24	3.18
Quotation at end of year.....do.....	3.75	3.00
Mine production of recoverable lead.....short tons.....	404,622	290,911
Southeastern Missouri district.....percent of total.....	39	40
Utah.....do.....	20	21
Idaho.....do.....	25	24
Juniper (Iri-State) region.....do.....	5	6
All other.....do.....	11	9
World smelter production of lead.....metric tons.....	1,401,000	1,167,000
United States.....percent of total.....	27	22
Mexico.....do.....	16	12
Australia.....do.....	11	15
Canada.....do.....	9	10
Spain.....do.....	8	9
All other.....do.....	29	31

¹ Subject to revision.

Capital has not been available for technical improvements in either mining or metallurgical practice due to forced economies and to the fact that most plants have a larger capacity than is needed.

The lead production of the United States, compared with world production and with that of copper and zinc, is shown in figure 1 on page 1.

The similarity of the graphs in trend and tonnage is noteworthy. A study of these and of the production tables shows a relatively greater decrease in the lead production of the United States compared with world output than in that of copper and zinc. Curtailment in lead output in foreign countries in 1932 was only 12 percent compared with a 33 percent decrease in the output of the United States exclusive of refined lead from foreign base bullion. The reason is that foreign consumption declined only 10 percent as against a decrease of 31 percent in the United States. Except the United States, Mexico shows the greatest reduction in output—84,000 metric tons—followed by Poland with a 20,000-ton decrease, while the lead production in Australia was increased 25,000 tons due to addition of the Mount Isa output. In Italy the 1932 production increased 6,800 tons.

Prices.—The average New York market price for lead in 1932 was 3.18 cents per pound compared with 4.24 in 1931 and 6.83 in 1929. There was a period of extremely low prices in July, when the quotation reached an all-time low of 2.65. Although prices rose to 3.65 in August, at the end of the year they were again down to 3 cents. St. Louis monthly prices were 0.10 to 0.21 cents below the New York quotations.

LEAD

The differential between London and New York was 0.10 cents in April to 1.48 cents in August, showing that it has never enabled the United States producers to compete on a differential. Internal competition is now keeping prices much below the possible London parity.

Average monthly and yearly quoted prices of lead at St. Louis, Mo., 1930-32, in cents per pound¹

Month	1930			1931		
	St. Louis	New York	London	St. Louis	New York	London
January.....	6.10	6.25	4.08	4.00	4.80	3.01
February.....	6.09	6.24	4.60	4.33	4.54	2.92
March.....	5.56	5.67	4.08	4.28	4.53	2.85
April.....	5.43	5.53	4.09	4.17	4.39	2.89
May.....	5.41	5.51	3.86	3.65	3.82	2.62
June.....	5.31	5.39	3.89	3.70	3.92	2.50
July.....	5.15	5.23	3.94	4.22	4.40	2.76
August.....	5.33	5.49	3.88	4.22	4.40	2.69
September.....	5.35	5.49	3.89	4.22	4.33	2.41
October.....	5.00	5.15	3.42	3.78	3.96	2.30
November.....	4.95	5.10	3.45	3.76	3.94	2.42
December.....	4.95	5.10	3.31	3.59	3.79	2.29
Average.....	5.38	5.52	3.92	4.05	4.24	2.64

¹ St. Louis: Metal Statistics, 1933, p. 333. Average daily quotations of soft metal (open market), as reported daily in the American Metal Market.

New York: American Metal Market, daily issues. Pig lead, New York (outside market from West).

London: Metal Statistics, 1933, p. 337. Average price of foreign lead. Prices in Metal Statistics, converted to cents per pound at average exchange rate reported by Board.

² London quotations in pounds sterling per long ton, as follows: 1930, £18.075; 1931, £17.075; 1932, £16.075.

Consumption by uses.—The quantity of lead in all forms consumed by domestic industry is estimated by the American Metal Market Statistics to be as shown in the following table:

Lead consumed in the United States,¹ 1928-32, in short tons

Purpose	1928	1929	1930
White lead.....	123,000	119,700	83,900
Red lead and litharge.....	31,000	30,000	32,000
Storage batteries.....	220,000	210,000	163,000
Cable covering.....	180,000	220,000	208,000
Building.....	96,000	96,000	67,000
Automobiles.....	17,000	18,000	11,000
Railway equipment.....	2,000	8,700	5,200
Shipbuilding.....	100	300	500
Amputation.....	39,600	41,100	33,300
Grapple.....	4,400	4,200	2,700
Roll.....	35,000	39,800	20,000
Bearing metal.....	32,000	33,000	20,000
Other.....	37,000	37,000	27,000
Alloy metal.....	17,000	18,000	16,000
Welding.....	32,000	31,500	21,000
Other uses.....	18,000	18,000	12,000
Total.....	40,000	60,000	40,000
	930,600	972,300	788,600

Source: American Bureau of Metal Statistics. These estimates are for the total quantity of lead consumed in the United States, exclusive of whether its origin be primary or secondary. Antimonial lead is included in the figures for storage batteries.

Based on reports from all large proportion of manufacturers in each industry. Based on estimates of manufacture and the quantity of lead used per unit of material of building is included the lead used in chemical construction. Estimates of persons engaged in the trades. Conjectural.

Lead consumed in the United States in 1932 was only approximately 400,000 tons, a decrease of 30 percent from 1931 and 59 percent from 1929, the year of record consumption. The storage-battery industries ranked first as consumers of lead, followed by its use as cable covering and as white lead in paints. The consumption in storage batteries is estimated at 138,000 tons in 1932, a reduction of 12 percent from 1931. Much of the lead used in storage batteries is of secondary origin.

Consumption in the cable industry dropped 53 percent compared with that of 1931 and 75 percent compared with 1929, reflecting the economies necessary in the communication business and lack of capital for new undertakings.

The above table shows that slightly less lead was consumed as white lead than for cable covering. An amount of lead oxide nearly equal to that indicated as white lead was consumed in storage batteries. There was a 45 percent reduction in consumption for building purposes and a 22 percent reduction in the use of lead for ammunition compared with 1931.

PRIMARY LEAD

Refinery production.—The following table traces the production of refined primary lead in the United States from 1928 to 1932.

Refined primary lead produced in the United States, 1928-32

Year	Production (short tons)				Sources (short tons)			Value	
	Desilverized lead ¹	Desilverized soft lead	Soft lead	Total production	From domestic ores and base bullion	From foreign ores	From foreign base bullion	Average per pound	Total
1928.....	506,603	40,465	225,003	781,071	626,202	20,032	128,237	\$0.058	\$90,604,000
1929.....	483,622	55,666	235,345	774,633	672,498	20,075	72,460	.063	87,604,000
1930.....	396,094	46,578	201,361	643,033	573,740	34,348	34,946	.050	64,303,000
1931.....	263,919	40,456	138,389	442,764	390,290	22,254	30,250	.037	32,765,000
1932.....	189,707	35,624	63,130	288,361	255,337	21,747	11,277	.030	17,302,000

¹ The lead content of antimonial lead is excluded (see p. 57).

² Desilverized soft lead is excluded.

The 1932 production of refined primary lead from domestic ores in the United States was 35 percent less than in 1931 and 55 percent less than in 1930. Lead derived from smelting foreign ores declined but little, while that from foreign base bullion decreased 63 percent.

Source of ore.—The following table shows the source of foreign ores smelted and refined in the United States in 1932. The total lead production from domestic ores is added, the approximate details of its source being given in a table on mine production on page 58.

The figures for total lead produced from domestic ore include both base bullion and refined lead and thus contain a large part of the antimonial lead produced from domestic ores.

The sharp decline in production of refined lead from Mexican base bullion in recent years is ascribed to the completion of additional refining capacity in Mexico and to more favorable freight rates from smelters to points of export in Mexico.

LEAD

Primary lead smelted or refined in the United States, 1928-32

Source	1928	1929
Domestic ore.....	642,697	685,902
Foreign ore:		
Australia.....	2	5
Canada.....	10,123	9,400
Europe.....	67	28
Mexico.....	14,839	16,807
South America.....	1,508	3,285
Other foreign.....	33	51
Foreign base bullion:		
Mexico.....	117,193	51,205
South America.....	11,044	21,105
Grand total.....	797,660	788,127

Soft lead.—Soft lead is produced principally from various ores of the Central States and in 1932 consisted of the total domestic production. Most of these ores are pig lead, but a substantial quantity is used in the manufacture of pigments. Undesilverized soft lead often has a relatively high antimony content and is resistant to corrosion by acids. It is used as chemical lead and is used chiefly in the manufacture of pipe, and sheets.

Soft lead produced in the United States from domestic ores, 1928-32

Year	Soft pig lead			Soft lead recovered in pigments	Total
	Undesilverized	Desilverized	Total		
1928.....	225,003	40,465	274,468	10,465	284,933
1929.....	235,345	55,666	291,011	9,429	300,440
1930.....	201,361	45,578	246,939	6,686	253,625
1931.....	138,389	40,456	178,845	5,722	184,567
1932.....	63,130	35,524	98,654	4,932	103,586

¹ Includes domestic refined lead, domestic lead in antimonial lead, and domestic lead in antimonial lead computed on different basis beginning with 1931.

Antimonial lead.—The principal uses of antimonial lead are in the manufacture of storage batteries, bearing alloys, and type metal. A large percentage of the antimonial lead used returns as scrap, and the smelting of such scrap is a major part of the antimonial lead used, the remainder being refined by the refining of base bullion and by mixing metallic lead with refined soft lead.

Antimonial lead produced at primary lead refineries, 1928-32

Year	Production (short tons)				Antimony content		Lead content	
	From domestic ore	From foreign ore	From scrap	Total	Short tons	Percentage	From domestic ore	Total
1928.....	17,930	15,128	12,418	45,476	4,787	10.5	(1)	(1)
1929.....	17,062	8,007	17,575	42,644	4,035	11.4	(1)	(1)
1930.....	8,918	4,793	11,086	24,797	2,967	12.0	(1)	(1)
1931.....	(1)	(1)	(1)	21,842	2,438	11.2	3,628	3,628
1932.....	(1)	(1)	(1)	21,024	2,495	11.9	3,577	3,577

¹ Segregation discontinued.

² Not recorded.

Pigments.—Refined pig lead is used in the manufacture of white lead, litharge, red lead, sublimed lead, and orange mineral. Sublimed lead and leaded zinc oxide are the principal pigments derived directly from lead-zinc ores.

Lead in pigments, ¹ 1928-32, by sources, in short tons

Year	Lead in pigments from—				Year	Lead in pigments from—			
	Domestic ore ²	Metal	Scrap	Total		Domestic ore ²	Metal	Scrap	Total
1928.....	10,405	242,914	654	254,033	1931.....	5,722	160,328	710	172,760
1929.....	9,429	248,657	2,427	260,513	1932.....	4,932	127,318	262	132,512
1930.....	6,680	190,182	689	197,557					

¹ Includes also lead recovered in zinc oxide and leaded zinc oxide.

² No pigments from foreign ore.

The pigment industries ranked first in 1932 as consumers of primary lead. The 132,000 tons of primary lead used in the manufacture of pigments were about 50 percent of the primary lead production. The principal uses of pigments are in the manufacture of paints and storage batteries. Further details are given in the chapter on Lead and Zinc Pigments and Salts.

Mine production.—Detailed information on mining activities in the various districts of the United States can be found in the chapters dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

The following tables show the mine production of recoverable lead by States and by districts from 1928 to 1932:

Mine production of recoverable lead, 1928-32, by States, in short tons

State	1928	1929	1930	1931	1932 ¹
Alaska.....	1,019	1,315	1,305	1,661	1,289
Arizona.....	7,100	8,027	4,246	982	1,008
Arkansas.....	38	51	53	78	4
California.....	946	715	1,780	1,879	1,100
Colorado.....	26,751	24,445	22,150	6,884	2,000
Idaho.....	145,323	148,695	134,058	90,305	71,000
Illinois.....	385	443	248	205	31
Indiana.....	25,276	26,596	12,910	7,082	6,490
Kansas.....	39	287	101		
Kentucky.....	195,393	198,409	199,632	160,121	117,189
Missouri.....	16,880	19,607	10,053	4,430	1,190
Montana.....	7,874	9,846	11,529	7,930	630
Nevada.....	7,805	11,130	10,378	11,209	10,780
New Mexico.....			(²)	(²)	(²)
New York.....			23,052	13,210	10,694
Oklahoma.....	43,687	46,513	5	2	
Oregon.....	7	10			
South Dakota.....	37				
Tennessee.....			(²)	(²)	(²)
Texas.....	348	425	198		
Utah.....	145,915	149,377	115,495	79,212	61,240
Virginia.....	(³)	(³)	(²)	(²)	(²)
Washington.....	542	508	576	1,386	940
Wisconsin.....	1,098	1,536	1,537	952	919
Undistributed.....			8,367	7,974	4,405
	4,627,153	4,647,995	558,313	404,022	290,911

¹ Subject to revision.

² Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

³ Bureau of Mines not at liberty to publish figures.

⁴ Exclusive of the output from Virginia, figures for which the Bureau of Mines is not at liberty to publish.

Of the total 1932 mine output, Missouri 24 percent, Utah 21 percent, and New Mexico 15 percent each. The total mine production was 404,022 short tons for 1931.

SECONDARY LEAD

The leading consumer of lead and the return of secondary metal is the storage battery. In 1932, 198,300 tons of secondary lead were recovered, of which half was from storage batteries. The balance was from cable piping, bearing, and type cases.

This recovery of secondary lead, which amounts to 78 percent of the production of primary lead, is a serious handicap to the lead-mining industry. The figures for secondary lead are given in the chapter on Secondary Lead.

Secondary lead recovered in the United States, 1928-32, in short tons

Year	Pig lead (short tons)	Lead alloy (short tons)
1928.....	138,000	17,000
1929.....	138,500	17,000
1930.....	129,000	12,000
1931.....	128,800	10,000
1932.....	128,000	7,000

¹ Compiled by J. P. Dunlop, of the Bureau of Mines.

IMPORTS AND EXPORTS

Imports of lead in base bullion, which decreased 58 percent in 1932, while imports of lead in other forms remained virtually the same as for 1931. The net imports of lead, offsetting in part the decrease from Mexico, show a small increase in tonnage.

In the following tables the lead imports are shown by classes and by countries. The bonded warehouses in various forms at the time of importation are also given. The last two tables show the tonnage of lead imported by classes and by destinations.

Statistics on imports for consumption, which include imports entered for immediate consumption, and for bonded warehouse draws from warehouses for domestic consumption, show that lead imported is smelted and refined in bond. Lead imported for consumption is much less than lead imported for consumption.

Lead imported into the United States, 1928-32, by classes, in short tons

[General imports]

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1928.....	25,915	128,468	661	155,044
1929.....	31,331	83,071	1,657	116,059
1930.....	30,377	38,630	200	78,218
1931.....	20,888	32,320	10	53,218
1932.....	21,001	13,462	44	34,507

¹ Reclaimed scrap, etc. No imports of pigs, bars, etc., were recorded for 1931.

Lead imported into the United States, in ore, base bullion, and refined, 1928-32, by sources, in short tons

[General imports]

Year	Canada	Mexico	South America	Europe	Other countries	Total
1928.....	7,177	137,592	10,204	28	43	155,044
1929.....	4,512	87,930	23,526	14	71	116,059
1930.....	17,268	36,721	22,472	113	1,642	78,218
1931.....	2,618	38,706	2,171	5,053	10,723	53,218
1932.....	2,459	13,545	2,811		10,039	34,507

¹ Of this total, 9,708 short tons were from Newfoundland and Labrador.
² Of this total, 10,598 short tons were from Newfoundland and Labrador.

Lead imported into the United States, in ore and matte, 1928-32, by countries, in short tons

[General imports]

Country	1928	1929	1930	1931	1932
Canada.....	7,131	3,953	17,257	2,614	2,439
Chile.....	504	2,295	3,313	1,866	2,211
Mexico.....	17,055	23,415	10,341	6,495	196
Newfoundland and Labrador.....		(¹)		9,708	10,359
Peru.....	1,170	1,601	831	194	471
Sweden.....			1,835	11	5,021
Other countries.....	55	67			67
	25,915	31,331	30,377	20,888	21,001

¹ Less than 1 ton.

Lead imported into the United States, in base bullion, 1928-32, by countries, in short tons

[General imports]

Country	1928	1929	1930	1931	1932
Mexico.....	119,935	63,458	20,350	32,210	13,462
Peru.....	8,625	19,605	18,280	110	
Other countries.....	8	8			
	128,468	83,071	38,630	32,320	13,462

LEAD

Lead remaining in warehouses in the United States, December 31, 1932, in short tons

[Stated in the form in which the material was entered]

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old	Year
1928.....	48,823	68,750	4,130	1931.....
1929.....	60,207	75,434	1,328	1932.....
1930.....	39,510	5,042	(¹)	

¹ Pigs, bars, and old included with base bullion; not recorded separately.

Lead imported for consumption in the United States, 1928-32, in short tons

Year	Lead in ore and matte ¹		Lead in base bullion		Pigs, bars, and old		Short tons
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons
1928.....	23,256	\$2,626,231	6,699	\$500,983	10,244	\$808,359	39,199
1929.....	10,823	1,160,533	6,198	627,455	10,069	1,052,087	27,090
1930.....	15,458	1,461,350	10,423	1,127,920	571	60,493	46,452
1931.....	10,734	1,104,191	10,436	671,002	10	1,703	41,180
1932.....	9,647	863,135	2,874	131,679	44	2,031	32,556

¹ Classification as follows: Jan. 1, 1928, to June 17, 1930, "Lead in ore and matte"; July 1, 1930, to Dec. 31, 1932, "Lead in ore, flue dust, and matte, n.s.p.t."

² Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded for 1931.

Miscellaneous products containing lead imported for consumption in the United States, 1928-32, in short tons

Year	Babbitt metal, solder, white metal, and other combinations containing lead			Type
	Gross weight (short tons)	Lead content (short tons)	Value	
1928.....	938	423	\$669,466	
1929.....	1,505	663	777,354	
1930.....	1,399	530	593,103	
1931.....	906	310	436,574	
1932.....	498	191	143,662	

Refined lead exported from the United States, 1928-32, in short tons

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)	Year	Pigs, bars, and old
	Short tons	Value			
1928.....	116,269	\$10,359,221	13,224	1931.....	21,001
1929.....	73,251	7,178,837	13,080	1932.....	13,462
1930.....	48,307	3,904,213	12,161		

Refined pig lead exported from the United States, 1928-32, by destinations, in short tons

Destination	1928	1929	1930	1931	1932
COUNTRIES					
Argentina.....	1,243	599	934	220	759
Brazil.....	2,439	1,538	874	1,382	133
Canada.....	132	141	9	58	133
France.....	4,028	2,202	3,001	318	224
Germany.....	23,552	9,745	823	52	1,344
Japan.....	21,210	10,416	15,653	17,301	20,219
Mexico.....	79	83	40	171	13
Netherlands.....	5,068	1,522	22	13	112
Philippine Islands.....	210	111	543	400	478
Sweden.....	5,310	7,255	7,557	392	3
United Kingdom.....	43,428	23,732	9,157	3	84
Uruguay.....	384	448	364	145	153
Other.....	8,554	9,469	9,330	1,204	153
	116,269	73,251	48,307	21,665	23,516
CONTINENTS					
North America.....	472	693	318	435	160
South America.....	4,834	3,852	2,442	1,903	863
Europe.....	87,161	50,649	27,899	795	1,793
Asia.....	23,802	18,055	17,289	18,524	20,700
Africa and Oceania.....		2	359	8	
	116,269	73,251	48,307	21,665	23,516

WORLD PRODUCTION

World smelter production in 1932 totaled 1,157,000 metric tons, of which the United States produced 251,365 tons (22 percent) as against 27 percent in 1931.

In spite of the low price for lead in the United States production continued to exceed consumption. Mexican production shrank considerably, but there was an increased production in Australia. The total figures show only a 12 percent curtailment in the foreign production against a 33 percent reduction in the United States output exclusive of refined lead from foreign base bullion. Further curtailment is necessary both in the United States and foreign countries to reduce stocks and bring the lead output into equilibrium with its market.

For the first time in many years the United States lead mines were second on the monthly production-record list. During July and August of 1932, Australian mines were first. The world output during recent months seems to have come to a resting point at about 100,000 tons per month.

The lead situation abroad has been complicated by depreciated foreign exchange, which enables the foreign countries off the gold standard to sell their production on a more favorable exchange basis, whereas payment for labor is made in depreciated currency. Australia is a good example of this situation.

The following table shows the world smelter production of lead from 1928-32, so far as statistics are available. Official figures are used wherever possible.

Duplication in figures showing world production is always possible as some countries sent "work lead" or base bullion to other countries for refining. Furthermore, secondary lead and antimonial lead are often included in the figures of foreign production, whereas the figures for the United States represent only refined primary lead smelted in this country, whatever the source of the ore; refined lead produced from foreign base bullion is excluded.

LEAD

World production of lead, 1928-32, in short tons

Country ¹	1928	1929
Argentina.....	8,291	9,000
Australia.....	157,665	180,300
Austria.....	8,135	6,800
Belgium.....	80,200	82,800
Canada.....	136,561	138,000
Chosen.....	719	300
Czechoslovakia.....	3,005	4,000
France.....	22,656	20,300
Germany.....	87,000	97,900
Great Britain.....	8,638	10,800
Greece.....	7,306	5,300
Hungary.....	(1)	100
India (Burma).....	79,642	81,600
Indo-China.....	10	22,000
Italy.....	21,220	22,000
Japan.....	3,653	3,300
Mexico.....	227,800	239,900
Northern Rhodesia.....	4,751	1,600
Norway.....	300	300
Poland.....	14,466	19,400
Portugal.....	37,078	35,700
Rumania.....	84	500
Russia.....	537	500
South-West Africa.....	4,592	4,200
Spain.....	5,004	2,800
Spain.....	130,950	142,700
Tunisia.....	17,606	18,800
Turkey.....	8,062	7,300
United States (refined) ²	592,238	636,900
Yugoslavia.....	13,875	9,400
	1,686,000	1,786,000

¹ By countries where smelted but not necessarily refined.

² In addition to the countries listed China smelts lead, but no record.

³ Approximate production.

⁴ Exclusive of secondary material (Metallgesellschaft, Frankfurt).

⁵ Data not available.

⁶ Year ended Sept. 30.

⁷ Year ended Mar. 31 of year following that stated.

⁸ Figures cover domestic refined and lead refined from foreign base bullion not included.

Australia.—The increase of 24,600 long tons in production is due largely to the increased output of the properties in Queensland. About 75,000 tons of lead averaging over 10 percent lead and 5 ounces of silver were treated at this mine. A third blast furnace was installed at the smelter, raising the output to 100,000 tons per month. As in the past, the output is derived from the lead and zinc concentrates of the Hill district. Reduction in wage scales and tax cuts aided producers in this district in 1932. All four principal companies were operating and having reopened in April after having been closed for improvements at the Port Pirie lead smelter. The continuous softening of the market for lead is noteworthy.

Exports of bullion and refined lead increased in 1932 and amounted to 172,000 tons. Europe took 142,700 tons, Great Britain being by far the largest consumer. The latter country increased about 18 percent, while Mount Isa bullion to the Northfleet refinery was a 10-percent tariff on non-British lead imports. Exports of lead ore and concentrates decreased.

A large part of Canada's lead production is exported. In 1932, 107,000 short tons of pig lead or 85 percent of the total production was shipped abroad. Great Britain took 57 percent and Japan 26 percent of the total. The 27-percent increase in shipments to Great Britain may be ascribed in part to the tariff imposed on non-British lead there. About 1,857 tons of lead in the form of ore were also exported in 1932.

Germany.—Germany ranks third in consumption of lead and sixth in smelter production. In 1932 it consumed about 123,000 metric tons and smelted about 95,000 tons but mined only 43,000 tons. To meet the requirements of industry and the export trade, 51,000 tons of pig lead and 67,000 tons of lead ore were imported. There were 5,000 tons of ore and 23,000 tons of pig lead exported. Newfoundland supplied 48 percent and Yugoslavia 19 percent of the lead ore imported. The principal sources of the pig lead were Australia, which supplied 48 percent of the total, and Mexico, 17 percent. Imports of lead ore increased 36 percent, whereas exports decreased 78 percent. The pig lead exported went to neighboring European countries.

During the current depression primary production of lead in Germany has been maintained fairly well, in spite of a severe decline in consumption. Comparing 1932 with the 5-year average (1925 to 1929), it is found that consumption dropped 38 percent, whereas smelter production increased 14 percent. Mine production declined only 8 percent. During 1932 the policy of Government aid through loans was continued on a broader basis by creation of a 6,000,000-mark fund, to be advanced to privately operated lead and zinc mines.

Spain.—Notwithstanding the low prices for lead and the political disturbances in Spain the decline in lead production was less severe than in many other countries. Smelter production declined from 109,630 metric tons in 1931 to 105,807 tons in 1932 (3 percent). Exports of pig lead decreased from 83,000 to 79,000 tons. Imports of Spanish lead into Great Britain were reduced 79 percent, owing to

the British tariff and the exchange situation, offset by increased shipments to France and over 50 percent of the total in 1932. In March called a conference of the leading mining companies and means of ameliorating the serious situation continued low prices and of averting increase by cessation of operations at the mines. Some State aid in the form of loans amounting to \$100,000,000 was proposed. Apparently a final decision was not reached. Complicated by the fact that some of the largest foreign companies.

Belgium.—Belgium ranked third in European production in 1932, with 70,000 metric tons, only 1 percent under the United States. Lead smelted in Belgium is derived largely from foreign ores. In 1932 10,000 tons of lead ores were imported in 1932 compared with 12,000 tons in 1931. Much lead is also derived from residues of zinc and copper ores smelted in Belgium. In 1932 Belgium produced 49,000 tons of pig lead, scrap, etc., and exported 49,000 tons of lead in pipes, sheets, etc.

India.—The Bawdwin mines of the Burma Corporation are responsible for the entire output of lead from India. The ore extracted was, lead, 22.6 percent; zinc, 1.48 percent; and silver, 20.1 ounces. The Corporation's economy in the cost of production made it possible to realize an improvement for 1932 despite the decline in the price of lead. The total lead production declined only 5 percent, while the lead declined from 68,640 long tons in 1931 to 64,800 long tons, or 11 percent. Great Britain took 75 percent of the 1932 shipments. In contrast to Australia, which increased their exports to Great Britain in 1932, India declined 9 percent.

Great Britain.—Great Britain produces less than the world's lead but ranks second in consumption of 21 percent of the total. This demand is supported by the fact that in 1932, 266,000 long tons of pigs and sheets were imported, a decrease of 14 percent from 1931. A larger portion of this was derived from the British dominions in 1932 than in 1931, the imposition of a 10 percent tariff on non-British lead in 1932. In 1932 Canada, Australia, and British Columbia supplied 10 percent of the total imports compared with 64 percent in 1931. Imports from Mexico and the United States dropped 14 percent. There was a large increase in shipments from the United States in 1932. A flow of lead bullion from Mount Isa. Approximate figures for 1932: Pigs, sheets, and pipe were exported in 1932.

Lead consumption in Great Britain has held up throughout the current depression. During the 1929 the yearly consumption averaged about 361,000 tons; during 1930 it was about 266,000 tons; and in 1931 being equivalent to 99 percent of the average. The consumption in 1932 amounted to 221,000 tons, the predepression average. In the British Empire the consumption has also been well maintained. From 1929 to 1932 the output averaged 361,000 tons. In 1930 the output was 266,000 tons, and in 1931 it was 221,000 tons.

but in 1931 dropped to 363,000 tons. In 1932 it rose to 370,000 tons. The lead consumption of the Empire in 1931 was estimated at approximately 300,000 tons, indicating a surplus production of 63,000 tons (about 21 percent of the total consumption) in that year.

The Northfleet refinery of the Britannia Lead Co., which began operating in October 1931, produced 39,447 tons of refined lead, 1,829,947 ounces of silver, and 65 tons of antimonial lead from Mount Isa bullion during the year ended October 31, 1932.

Poland.—Due to the accumulation of large stocks, lack of demand, and low prices the lead smelters in Poland suspended operations in September. Operations were resumed in January 1933. The 1932 production was 63 percent less than in 1931. Exports declined from 20,600 metric tons in 1931 to 5,900 tons in 1932.

Yugoslavia.—Trepca Mines, Ltd., has proved to be one of the few producers able to operate profitably under the low prices prevailing in 1932. During the year ended September 30, 1932, the company treated 397,963 long tons of ore, from which 48,566 tons of 76 percent lead concentrates, containing 27 ounces of silver per ton, and 62,192 tons of 50 percent zinc concentrates were obtained. The ore mined averages 11.5 percent lead, 10.5 percent zinc, and 3 ounces silver. Mill capacity was increased nearly 50 percent during the year. Earnings permitted payment of a 10-percent dividend. Most of the concentrates produced are exported through Salonika.

ZINC

By E. W. PEARSON

Nineteen hundred and thirty-two ranks as the lowest factory years in the history of the United States zinc industry. The average price for the year was the lowest on record and the production of primary zinc was equivalent to only 3

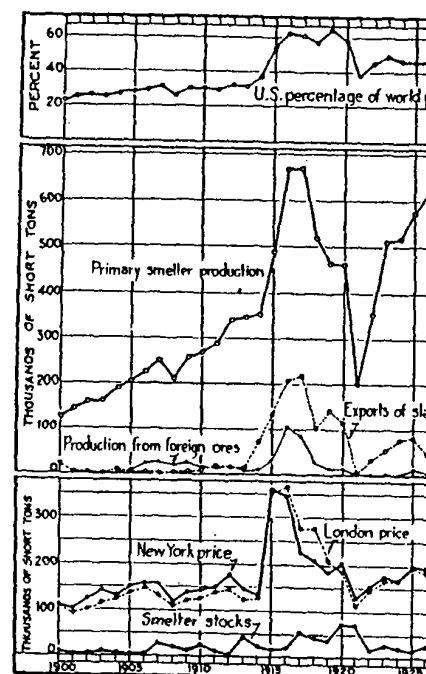


FIGURE 4.—Trends in the United States zinc industry, 1900-1932. Imports are not shown, since they seldom exceed 500 tons a year.

average from 1925 to 1929 and was the lowest in the history of the industry. The production and consumption of primary zinc both fell below the 1925 to 1929 average and likewise the price of zinc. Most of the principal zinc-producing countries reported deficits in 1932.

Figure 4 shows trends in the United States zinc industry.

The year was not without some hopeful aspects, however. The decline in price reached its lowest point in May, and during the rest of the year there was substantial recovery, so that by the end of December the quotation had regained the level of early January—the first time since 1928 that the price was not lower at the end of the year than at the beginning. The decline in the average price of zinc during the depression has been less pronounced than that of lead and copper.

During the first 7 months of 1932 the slump in production failed to keep pace with the shrinkage in demand, resulting in an increase in stocks, but during the last 5 months shipments exceeded production to such an extent that there was a net decline in stocks for the year. At the close of 1932 zinc stocks were equivalent to less than 3 months of normal consumption. The industry is thus in a relatively favorable statistical position and should be one of the first of the metal group to realize improvement should there be an increase in industrial activity.

Outside the United States the statistical position also was improved by a large and steady decline in stocks, but price increases commensurate with this improvement were not realized because of the sharp competition for markets and the hazardous existence of the International Zinc Cartel, which had controlled production and reduced stocks. The foreign situation was aggravated further by depreciated currencies, imposition of tariffs, and Government subsidies; nevertheless production, consumption, and even price suffered less severe declines abroad than in the United States.

A statistical summary follows, in which the zinc industry of the United States in 1930, 1931, and 1932 is compared with the 5 pre-depression years, 1925-29.

Salient statistics of the zinc industry in the United States, 1925-32

	1925-29 average	1930	1931	1932
Production of primary zinc:				
From domestic ores.....short tons..	589,648	480,361	291,906	207,148
From foreign ores.....do.....	12,734	8,684		
	602,382	489,045	291,906	207,148
Electrolytic.....percent of total..	21	25	28	11
Distilled.....do.....	79	74	72	89
Production of secondary slab zinc.....short tons..	65,380	49,300	34,800	20,000
Stocks on hand at primary smelters (Dec. 31).....do.....	45,575	167,293	143,592	128,100
Primary zinc available for consumption.....do.....	544,016	408,469	312,592	213,248
Price—prime western at St. Louis:				
Average for year.....cents per pound..	6.76	4.56	3.64	2.80
Highest quotation.....do.....	8.00	5.45	4.12½	3.30
Lowest quotation.....do.....	5.40	3.95	3.12½	2.20
Price—yearly average at London.....do.....	0.46	3.60	2.52	2.10
Price—yearly average at London.....short tons..	724,720	595,425	410,318	285,000
Mine production of recoverable zinc.....percent of total..	49	36	29	20
Tri-State district (Goplin).....do.....	30	33	30	20
Western States.....do.....	21	31	41	20
Other.....do.....	21	31	41	20
World smelter production of zinc.....short tons..	1,435,000	1,837,000	1,102,000	897,000

1 Subject to revision.

DOMESTIC PRODUCTION

Production of primary and secondary slab zinc.—Production of primary zinc in 1932 was the lowest since 1921, and the recovery of secondary unalloyed zinc the lowest since 1908. Compared with the

ZINC

5-year period 1925-29, 1932 primary production decreased 66 percent and of secondary zinc 69 percent. Increased 66 percent in quantity and 85 percent in value. All primary zinc was derived from domestic ores. Shows the production of primary and secondary zinc for the past 10 years.

Primary and secondary slab zinc produced in the United States, 1921-32

Year	Primary (short tons)			Secondary (short tons)		
	Domestic	Foreign ¹	Total	Redistilled	Remelted	Total
1921.....	508,335	2,090	510,424	39,434	25,776	65,210
1922.....	515,831	1,508	517,339	35,488	23,400	58,888
1923.....	555,631	17,315	572,946	39,181	22,249	61,430
1924.....	611,991	0,431	612,422	40,799	23,771	64,570
1925.....	676,900	15,556	692,456	42,784	22,016	64,800
1926.....	591,625	11,050	602,675	48,606	22,034	70,640
1927.....	612,180	13,311	625,491	47,348	18,052	65,400
1928.....	489,861	8,684	498,545	34,849	14,451	49,299
1929.....	201,900		201,900	21,625	13,175	34,800
1932.....	207,148		207,148	14,718	5,282	20,000

¹ Since 1920 all foreign zinc smelted in the United States has been domestic. Includes 22 tons of secondary electrolytic zinc in 1930 and 312 tons in 1932.

The Bureau of Mines classifies slab-zinc production as primary or secondary according to whether it was derived from domestic or foreign sources. Primary zinc is classified as domestic if the source of the ore smelted. Secondary zinc is classified as such if it is remelted according to the method of recovery. "Primary zinc", as used herein, refers only to zinc derived from the immediate byproducts of primary zinc smelting, such as galvanizers' drosses, ashes, and scrap metal to which it is added. There is therefore duplication in the table above, inasmuch as the same metal may be recovered two or more times in a single year. Although it enters the market indistinguishable from ordinary zinc, it becomes part of the supply of zinc available to the industry. It is deemed advisable to maintain a separate record of secondary zinc; otherwise the long-time record of zinc production would include metal that is constantly reworked.

Distilled and electrolytic zinc.—Production of distilled and electrolytic zinc declined more sharply in 1932 than that of distillate. In the 5-year period 1925-29 electrolytic zinc accounted for 21 percent of the total primary production. In 1930 it increased, but in 1932 it fell to only 11 percent. The decline may be ascribed to the inability of electrolytic zinc to compete with materials due to their dependence on custom-made materials where mining has been at a particularly low level. The extremely low metal prices of recent years. Electrolytic zinc declined 85 percent in 1932, from 21 percent, and redistilled secondary decreased 75 percent. The decline in production of redistilled secondary zinc is more pronounced at primary than at secondary smelters.

The sharp decline in electrolytic zinc production in 1932 is reflected in the decreased production of high-grade zinc. Compared with 1931 production of high-grade zinc declined 47 percent, whereas that of prime western fell only 27 percent.

The production of primary and secondary electrolytic and distilled zinc, apportioned by method of reduction and by grades, is given in the following table.

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1928-32, in short tons

APPORTIONED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled primary	Redistilled secondary ¹		Total
			At primary smelters	At secondary smelters	
1928.....	100,160	442,421	13,554	35,112	651,247
1929.....	156,235	409,212	11,425	35,923	672,795
1930.....	131,166	366,879	8,500	26,349	532,894
1931.....	81,898	210,098	5,343	16,282	313,621
1932.....	23,208	183,940	1,590	13,122	221,860

APPORTIONED ACCORDING TO GRADE

Year	Grade A (high grade)	Grade B (intermediate)	Grade C (brass special)	Grade D (selected)	Grade E (prime western)	Total
1928.....	197,675	41,779	73,957		337,836	651,247
1929.....	207,321	27,430	96,163		341,881	672,795
1930.....	150,494	20,070	93,270		257,051	532,894
1931.....	83,445	23,924	73,274		132,978	313,621
1932.....	44,195	13,295	66,844		97,532	221,860

¹ For total production of secondary zinc see below.

² Includes 22 tons of secondary electrolytic zinc.

³ Includes 312 tons of secondary electrolytic zinc.

Production of primary zinc by States.—Illinois and Pennsylvania again ranked first and second in zinc smelting in 1932; but Montana, which ranked third in 1931, fell to fifth. Oklahoma was the only State to report an increase in 1932. Kansas failed to report zinc production for the first time since 1877. West Virginia and Texas, included in "other States", showed substantial declines in 1932.

Primary zinc produced in the United States, by States, 1928-32, in short tons

Year	Arkansas	Idaho	Illinois	Kansas	Montana	Oklahoma	Pennsylvania	Other States	Total	Total value
1928.....	20,505	1,939	103,765	33,923	158,221	106,557	108,802	68,869	602,581	\$73,515,000
1929.....	17,923	16,582	112,425	37,795	138,019	111,683	108,167	82,853	625,447	\$82,559,000
1930.....	13,917	9,509	103,331	13,682	112,908	79,742	101,916	63,040	498,045	\$77,812,000
1931.....	3,392	8,400	70,290	4,090	63,090	26,924	65,445	43,759	291,996	\$22,192,000
1932.....	639	5,955	67,610		17,250	27,226	55,530	32,932	207,148	\$12,429,000

Secondary zinc.—Besides the redistilled and remelted secondary slab zinc (unalloyed) previously mentioned a large quantity of secondary zinc is recovered each year in the form of alloys, zinc dust, zinc pigments, and zinc salts. The total quantity recovered in 1932, including the unalloyed zinc, was 70,600 tons, a decrease of 31 percent from 1931 and the lowest output since 1910. Further details are given in the chapter on Secondary Metals.

Byproduct sulphuric acid.—An important byproduct of the zinc industry is sulphuric acid made from the sulphur dioxide evolved in the roasting of zinc blende. Some of the quantities of sulphur in addition to blende to produce their acid-producing capacity. The following table shows the production of sulphuric acid at zinc-blende roasting plants in the United States, 1928-32, in short tons.

Production and value¹ of sulphuric acid (60° B. basis) at zinc-blende roasting plants in the United States, 1928-32, in short tons and dollars

Year	Made from zinc blende		Made from sulphur	
	Short tons	Value	Short tons	Value
1928.....	558,537	\$5,523,931	546,204	\$5,401,000
1929.....	627,019	6,038,183	640,980	6,230,000
1930.....	536,614	5,187,693	474,092	4,685,000
1931.....	426,618	3,745,700	381,216	3,747,000
1932.....	341,340	2,604,134	244,644	1,859,200

¹ At average of sales of 60° acid.

² Includes acid made from small quantity of pyrites.

Production declined 27 percent in 1932, and the low rate of zinc production the quantity of sulphuric acid showed a considerably smaller decrease than sulphur. In 1931, 53 percent of the total was made from sulphur, but in 1932 the percentage was 70 percent, respectively. The average price for sulphuric acid by producers in 1932, was 13 percent less than in 1931. A list of acid plants using gases derived from zinc blende was given on pages 273 and 274 of the Minerals Yearbook, United States, 1931, part I. The following table shows the production from 1929 to 1932:

Details of production of byproduct sulphuric acid at zinc-blende roasting plants in the United States, 1929-32, in short tons and dollars

	1929
Number of establishments.....	21
Blende used..... short tons	682,066
Sulphur used..... do	176,535
Acid reported as 50°-60° B.:.....	
Produced (expressed as 60° B.)..... short tons	694,990
Consumed at works (expressed as 60° B.)..... do	33,474
Sold (expressed as 60° B.)..... do	657,785
Value of acid sold.....	
Total.....	\$6,336,444
Average.....	\$9.63
Acid reported as 60° B. and stronger:	
Produced (expressed as 60° B.)..... short tons	482,507
Consumed at works (expressed as 60° B.)..... do	67,670
Sold (expressed as 60° B.)..... do	414,617
Value of acid sold.....	
Total.....	\$6,381,566
Average.....	\$14.45
Total acid sold, equivalent in 60° B.:.....	
Quantity..... short tons	1,187,726
Value.....	\$12,718,000
Total acid consumed at works (60° B.)..... short tons	114,678

¹ Includes small quantity of pyrites.

Rolled zinc.—Statistics of production of rolled zinc for 1931-32 are reported on a different basis than previously to eliminate duplication of tonnage, caused by rolling mills including rerolled zinc made from scrap originating in their own plants in their statement of production. Since such scrap represents a revolving stock within the plant it has no effect on the market, and its inclusion in rolled-zinc production leads to erroneous conclusions on the quantity of slab zinc used each year in the zinc-sheet industry. Data needed for corrections before 1931 are not available at this time.

Production of rolled zinc and quantity available for consumption in the United States, 1931-32

	1931			1932		
	Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound
Sheet zinc not over 0.1 inch thick.....	15,468	\$2,532,000	\$0.084	12,291	\$1,804,000	\$0.073
Roller plate and sheets over 0.1 inch thick.....	546	90,000	.082	454	58,000	.064
Strip and ribbon zinc ¹	33,290	4,475,000	.067	26,986	3,167,000	.059
Total zinc rolled.....	49,304	7,147,000	.072	39,731	5,029,000	.063
Imports.....	20	2,300		39	4,600	
Exports.....	2,750	461,000	.084	3,010	433,000	.072
Available for consumption.....	46,566			36,760		
Slab zinc (all grades) ²			.038			.030
Value added by rolling.....			.034			.033

¹ Figures represent net production. In addition 9,031 tons in 1931 and 8,066 tons in 1932 were rerolled from scrap originating in fabricating plants operated in connection with zinc-rolling mills.

² Revised figures.

Production of rolled zinc declined 19 percent in 1932 compared with 1931; all gages shared in the decline. The average value per pound of rolled zinc declined only 12 percent, whereas slab zinc declined 21 percent, so that the unit value added by rolling was very well maintained. The increased production of strip and ribbon zinc in 1931 due to the abnormal demand for fruit-jar covers was not maintained in 1932. Trade statistics indicate a 12-percent decline in the consumption of rolled zinc in dry-cell batteries. Normally the battery industry consumes about one third of the rolled zinc produced.

The following are the proportions of various grades of zinc used in the manufacture of 39,731 tons of rolled zinc in 1932: Brass special, 55 percent; prime western, 18 percent; high-grade spelter, 14 percent; electrolytic, 10 percent; and intermediate, 3 percent. Stocks of slab zinc at rolling mills declined from 4,863 tons on January 1 to 4,750 tons on December 31, 1932.

Zinc dust.—Commercial production of zinc dust in the United States began in 1910 and reached a maximum of about 11,500 tons in 1920. From 1922 to 1927 the annual production averaged about 8,000 tons. In 1932, 8,046 tons were produced, 24 percent less than in 1931.

ZINC

Zinc dust¹ sold by producers in the U.

Year	Short tons	Value		Primary zinc recovered as zinc dust (short tons) ²	Year
		Total	Average per pound		
1928.....	9,172	\$1,475,875	\$0.080	2,608	1931.....
1929.....	11,050	1,864,672	.084	3,263	1932.....
1930.....	9,237	1,205,740	.065	2,559	

¹ The zinc dust produced is principally "blue powder." Some of the years shown, but the Bureau of Mines is not at liberty to publish figures for the years 1929 and 1930.

² The amount of secondary zinc dust recovered is shown in the table.

³ Includes a small quantity of zinc in dust made from slab zinc.

Zinc pigments and salts.—Zinc oxide, lead oxide, and zinc phosphate are the principal pigments of zinc, and are the principal salts. These products are produced from various zinciferous materials—ores, metal scrap, and waste. Details of the production of zinc pigments and salts are given in a chapter entitled "Lead and Zinc Pigments and Salts" in the annual report of the Bureau of Mines. The total zinc content of all zinc pigments and salts produced in the United States was 92,645 tons, 25 percent less than in 1931.

Mine production.—The following table shows the quantity of recoverable zinc in the United States, by State, in 1932.

Mine production of recoverable zinc in the United States, 1932

State	1928
Western States:	
Arizona.....	639
California.....	35,731
Colorado.....	31,263
Idaho.....	82,830
Montana.....	3,398
Nevada.....	31,203
New Mexico.....	46,929
Oregon.....	43
Utah.....	232,036
Washington.....	
Central States:	
Arkansas.....	86
Illinois.....	17
Kansas.....	107,261
Kentucky.....	92
Missouri.....	12,974
Oklahoma.....	180,252
Wisconsin.....	18,417
Eastern States:	
New Jersey.....	319,089
New York.....	99,871
Tennessee and Virginia ¹	11,267
	32,917
	144,045
	698,170

¹ Figures for Western States production subject to revision. Bureau of Mines not at liberty to publish figures for Tennessee and Virginia.

The 1932 mine production of zinc declined 31 percent compared with 1931 and constituted only 39 percent of the 1929 output. All the important zinc-producing States shared in the decline in 1932, but since 1929 production has dropped over 70 percent in each of the Western and Central States areas and only 24 percent in the Eastern States. The more favorable position of the eastern mines may be ascribed to the higher zinc content of the ores, large-scale operations, the proximity to markets, and the fact that most of the eastern zinc-mining companies also manufacture the various zinc products required for the market, thus deriving all the benefits arising from the efficiency of vertically integrated industry. Another important factor is that most of the production in the Eastern States is derived from ore bodies where zinc is the principal constituent, whereas in the West zinc is largely a byproduct depending on the production of other metals such as lead and silver, which has been unprofitable in many mines in recent years.

The table that follows shows the output of the principal zinc-producing districts of the United States during the past 5 years. Further details of operations in these districts are given in the State reports included in this volume.

Mine production of recoverable zinc in the principal zinc-producing districts of the United States, 1928-32, in short tons

District	State	1928	1929	1930	1931	1932
Joplin region.....	Kansas, Missouri, Oklahoma.	297,020	309,438	216,961	119,168	90,660
New Jersey.....	New Jersey.....	99,871	103,740	97,626	94,285	81,400
Eastern Tennessee.....	Tennessee.....	32,917	40,558	48,147	38,312	18,612
Austinville.....	Virginia.....	22,246	21,794	22,302	26,608	21,370
Bingham.....	Utah.....	11,257	10,250	22,471	24,100	16,794
St. Lawrence County.....	New York.....	23,205	22,865	16,638	20,817	(?)
Willow Creek.....	New Mexico.....	28,005	43,046	33,145	18,934	(?)
Coeur d'Alene region.....	Idaho.....	1,400	420	14,272	13,250	7,522
Battle Mountain.....	Colorado.....	18,434	17,017	12,567	10,068	7,522
Upper Mississippi Valley.....	Iowa, northern Illinois, Wisconsin.	23,785	27,065	10,543	9,436	17,650
Park City region.....	Utah.....	7,545	11,224	15,319	7,050	(?)
Central.....	New Mexico.....	2,685	6,498	11,086	6,708	(?)
Pioche.....	Nevada.....	14,802	13,414	11,519	2,887	180
Leadville.....	Colorado.....	3,457	3,473	4,307	1,220	40
Southeastern Missouri region.....	Missouri.....	17,371	14,403	10,434	41	14
San Juan Mountains.....	Colorado.....	73,948	50,550	13,984	(?)	(?)
Summit Valley (Butte).....	Montana.....	12,714	11,429	9,839		
Eureka.....	Colorado.....					

¹ Subject to revision.

² Data not available.

STOCKS

Stocks of zinc at primary reduction plants declined 11 percent more in 1932. At the end of the year they were 23 percent below the recent high at the close of 1930 but were nearly three times as large as the average from 1925 to 1929. Stocks at secondary distilling plants increased in 1932, but the total at primary and secondary plants was 10 percent under the previous year. An analysis of this decrease shows that stocks of the higher grades of zinc (grades A and B) declined 49 percent, while the lower grades (C, D, and E) increased 16 percent. At the beginning of 1932 there were on hand 58,678 tons of grades A and B and 87,411 tons of grades C, D, and E. At the close of the year the tonnages were 30,085 and 101,477, respectively.

ZINC

Stocks of zinc on hand at zinc-reduction plants in the United States, 1928-32, in short tons

	1928	1929
At primary reduction plants.....	47,041	85,373
At secondary distilling plants.....	1,391	89,432
	48,432	174,805

The decline in stocks of smelted zinc was a decrease in stocks of zinc in the form of ore in the beginning of 1932 over 87,000 tons of content with an estimated recoverable zinc content. At the end of the year this was reduced to only 43,000 tons representing about 23,000 tons of metal. This was caused by drastic curtailment of production of zinc. Stocks of slab zinc outside the United States, under the International Zinc Cartel, declined from 1,000,000 tons on December 31, 1931 to 164,000 tons on December 31, 1932. Stocks may therefore be roughly estimated at the beginning of 1932 and 296,000 tons at the end of 1932.

DOMESTIC CONSUMPTION

New supply.—The supply of new zinc available in 1932 was 32 percent less than in 1931 and 63 percent less than in 1928 but exceeded that in 1921 by 10 percent. The following table gives the quantity of zinc consumed in the United States during the past 5 years.

Primary slab zinc available for consumption in the United States, 1928-32, in short tons

	1928	1929
Supply:		
Stock Jan. 1:		
At smelters.....	53,522	148,625
Production.....	602,581	625,373
Imports, foreign.....	3	3
Imports, domestic, returned.....		
Total available.....	656,106	674,001
Withdrawn:		
Exports, foreign, from warehouse.....	(?)	(?)
Exports, foreign, under drawback.....		
Exports, domestic.....	29,614	10,100
Stock Dec. 31:		
At smelters.....	48,432	85,373
Total withdrawn.....	78,046	105,473
Available for consumption.....	578,060	568,528

Includes stocks at secondary distilling plants.
Foreign exports included under domestic exports.

In the foregoing table an attempt has been made to show the quantity of primary slab zinc or zinc produced from ore at smelters produce a substantial tonnage of recoverable zinc, of which is inseparable from primary metal.

stocks at the end of the year and exports of domestic zinc probably contain some secondary metal, although the amount is relatively small. More precise segregation of figures for primary and secondary metal is virtually impossible. As the table does not consider the fluctuation in consumers' stocks, only the general trend of consumption of primary zinc is indicated.

Industrial use of slab zinc.—In addition to the new supply noted above, a large tonnage of secondary slab zinc is available each year for industrial use. The American Bureau of Metal Statistics estimates the total industrial use of primary and secondary zinc during the past 5 years as follows:

Estimated industrial use of zinc in the United States, 1928-32, in short tons¹

Purpose	1928	1929	1930	1931	1932
Galvanizing:					
Sheets.....	144,100	142,800	103,900	77,100	52,500
Tubes.....	54,200	52,200	38,800	29,300	18,000
Wire.....	41,300	39,000	25,100	21,600	12,100
Wire cloth.....	8,400	10,800	9,400	6,900	4,400
Shapes ²	43,000	45,200	39,800	34,100	24,000
Brass and casting³:					
Rolled zinc ⁴	291,000	290,000	217,000	108,000	109,000
Die castings.....	174,000	185,000	120,000	98,000	66,000
Other purposes ⁵	73,500	68,300	51,400	58,300	48,000
Die castings.....	30,000	36,000	21,500	20,000	17,000
Other purposes ⁵	58,000	55,000	41,000	34,700	27,000
	620,500	634,300	450,000	379,000	297,000

¹ Year Book, American Bureau of Metal Statistics, 1932, p. 73.

² Includes pipe-line hardware, hollow ware, chains, and all articles not elsewhere mentioned. The estimates for the use of slab zinc under this head, and also for wire cloth, are probably incomplete.

³ Includes all casting other than die casting, slush casting, and battery zinc.

⁴ Includes some duplication of tonnage. (See p. 72.)

⁵ Includes slab zinc used for manufacture of French oxide, lithopons, atomized zinc dust, wire, zinc for wet batteries, slush castings, and for the desilverization of lead.

The estimated industrial use of zinc in 1932 decreased 30 percent and was equivalent to the normal consumption of about 1907. It was 2 percent above the recent low in 1921 but 56 percent below the average of the 5 years from 1925 to 1929.

While there was no startling development in the field of new uses in 1932 considerable progress was made in the direction of laying a foundation for the return of normal business. The industry continued its campaign to improve the quality and popularity of zinc-coated (galvanized) iron and steel. The success of this campaign is indicated by the fact that 75 percent of the manufacturers of galvanized sheets have been licensed to produce the heavy-coated ware sponsored by the American Zinc Institute. Heavy coatings of high-purity zinc are now being applied electrolytically to steel wire, and the increased ductility thus obtained is expected to expand greatly the market for zinc-coated wire. The increase in the use of rolled zinc for fruit-jar covers reported in 1931 was not maintained in 1932.

PRICES

The price of zinc reached new record lows during 1932 but recovered enough for the quotation at the close of the year to be the same as at the beginning. The St. Louis quotation for prime western zinc averaged 2.88 cents per pound for the year, a decline of 21 percent

from 1931 and 56 percent from the average of 1932 the quotation stood at 3.12½ cents downward. On April 25 the New York quotation fell below 3.00 cents for the first time. May 16, when a final record low of 2.30 (New York) was established. The previous low was in 1895. During the latter part of the year a reversal of trend following an announcement of increased ore production in the tri-State district; during the middle of July the quotation again to 2.50 cents. During the next 2 months an abrupt rise resulting from the improvement in the middle of September. From this recession to 3.00 cents late in October. The quotation settled to 3.12½ cents, where it stood in December.

The following table presents a 5-year average of 1932 quotations in New York and 2.12 cents (Gold basis) in London. The imposition of the British embargo in 1931, did not have any appreciable effect on the London quotation (gold basis) having declined in price in the United States probably due to the more favorable statistics about by Cartel activities.

Prices of zinc and zinc concentrates

Average price of common zinc at—	
St. Louis (spot).....	cents per pound.
New York.....	do.
London.....	do.
Excess New York over London.....	do.
Price per short ton.....	dollars.
Price of zinc content.....	cents per pound.
Smelter's margin.....	do.
Price indexes (1925-29 average = 100):	
Zinc (New York).....	
Lead (New York).....	
Copper (New York).....	
Nonferrous metals ¹	
All commodities ¹	

¹ Based on price indexes of the U. S. Department of Labor.

The price indexes shown in the foregoing table has fared somewhat better than lead and copper. Comparing average prices in 1932 with the 1929 zinc declined 54 percent, while lead and 62 percent, respectively. The nonferrous metals declined 30 percent. The effect of these declines has been offset by a 34 percent decline in the price of all commodities.

The price of 60 percent zinc concentrates at Joplin averaged \$17.83 per ton in 1932, a decline of 21 percent from 1931 and the lowest since 1894. According to the Joplin Globe weekly average prices ranged from \$14 to \$21 per ton in 1932. The 1932 average was equivalent to 1.49 cents per pound of zinc contained. Since the St. Louis price of zinc averaged 2.88 cents the difference of only 1.39 cents per pound covers metallurgical losses and the cost of smelting and marketing, and such smelting profits as are realized. This was less than half of the smelter's margin of 2.96 cents per pound in 1929.

The following table shows the monthly fluctuations in the quotations of common zinc at St. Louis and London and of 60 percent zinc concentrates at Joplin during 1931 and 1932. The New York quotation for slab zinc exceeds that at St. Louis by the freight differential—0.35 cent per pound in 1931 and 0.37 cent in 1932.

Average monthly quoted prices of common zinc (prompt delivery or spot) at St. Louis and London, and of 60 percent zinc concentrates at Joplin, 1931-32¹

Month	1931			1932		
	60 percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)		60 percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)	
		St. Louis	London		St. Louis	London
January.....	26.00	4.03	2.76	17.40	3.02	2.21
February.....	26.26	4.02	2.78	17.85	2.83	2.14
March.....	25.00	4.01	2.64	17.57	2.79	2.08
April.....	23.00	3.99	2.46	17.00	2.74	1.95
May.....	20.00	3.31	2.28	14.55	2.53	1.84
June.....	21.00	3.40	2.56	10.20	2.79	1.85
July.....	22.53	3.90	2.66	17.47	2.55	1.84
August.....	23.00	3.82	2.48	18.22	2.70	2.11
September.....	23.00	3.74	2.34	19.83	3.50	2.40
October.....	20.25	3.38	2.21	18.32	3.05	2.26
November.....	18.35	3.20	2.30	17.75	3.10	2.23
December.....	18.66	3.15	2.16	18.20	3.12	2.26
Average for year.....	22.69	3.64	2.52	17.83	2.88	2.15

¹ All quotations from Metal Statistics, 1933. Conversion of English quotations into American money based on average rates of exchange recorded by the Federal Reserve Board of the Treasury.

The following table shows the actual prices received by producers for various grades of zinc during the past 5 years. It will be noted that all producers do not realize the premiums usually quoted in the trade journals for the higher grades of zinc.

Average price of zinc received by producers, 1928-32, by grades, in cents per pound

	1928	1929	1930	1931	1932
Grade A (high grade).....	6.18	6.80	4.92	4.00	2.15
Grade B (intermediate).....	5.90	6.44	4.71	3.63	2.15
Grades C and D (select and brass special).....	6.08	6.42	4.69	3.73	2.15
Grade E (prime western).....	6.1	6.6	4.8	3.8	2.15
All grades.....	6.1	6.5	4.6	3.6	2.15
Prime western; average spot quotation at St. Louis.....	6.0	6.5	4.6	3.6	2.15

¹ American Metal Market quotes average prices of high grade and brass special as follows: High grade (f.o.b. New York), 1928, 7.74 cents; 1929, 7.84 cents; 1930, 5.58 cents; 1931, 4.63 cents; 1932, 3.99 cents. Brass special (f.o.b. East St. Louis), 1928, 6.11 cents; 1929, 6.00 cents; 1930, 4.64 cents; 1931, 3.73 cents; 1932, 2.96 cents.

ZINC-REDUCTION P

Zinc smelters.—Disturbed industrial condition in 1929 of large continuously operating sharply curtailed activities during the past horizontal-type retorts. At the end of 1929 operating 95,460 retorts. On December 31, 1932, were using 20,613 retorts, a slight increase over 19,875 retorts at the close of 1931. Regular retorts in plants operating at the end of 1932, 40 continuously operating retorts, but data on the number in operation is not available.

The following table shows the primary zinc smelting plants in the United States at the end of 1932:

Primary zinc-smelting plants in the United States

Operating company (A = acid plant situated at the smelter)	
Athletic Mining & Smelting Co.	For
Van Buren Zinc Co. ¹	Van
American Zinc Co. of Illinois (A)	American
Hegeler Zinc Co. (A)	Hegeler
Illinois Zinc Co. (A)	Illinois
Mathiessen & Hegeler Zinc Co. (A)	Mathiessen & Hegeler
Mineral Point Zinc Co. (A) ²	Mineral Point
Grasselli Chemical Co. ³	Grasselli
American Steel & Wire Co. ⁴	American Steel & Wire
Blackwell Zinc Co., Inc. ⁵	Blackwell
Eagle-Picher Mining & Smelting Co.	Eagle-Picher
National Zinc Co., Inc. (A)	National
Nicholson Corporation ⁶	Nicholson
Quinton Smelter Co. ⁷	Quinton
American Steel & Wire Co. (A)	American Steel & Wire
American Zinc & Chemical Co. (A)	American Zinc & Chemical
New Jersey Zinc Co. (of Pennsylvania) (A)	New Jersey Zinc
American Smelting & Refining Co.	American Smelting & Refining
Grasselli Chemical Co. ⁸	Grasselli
United Zinc Smelting Corporation (A)	United Zinc Smelting
Total retorts.....	20,613
Number of retorts in use at end of year.....	20,613
Percent of total.....	100

¹ Idle since 1927.

² Idle throughout 1932.

³ Horizontal-retort plant idle Dec. 31, 1932.

⁴ Data not available.

The smelters of the Athletic Mining & Smelting Co. were idle at the end of 1932, but were reopened near the close of the year. The American Zinc Co. operated its plant for a few months during 1932. In addition to the primary zinc smelting plants, the Missouri Zinc Co. has a smelter which formerly treated ores but in recent years has been used for secondary materials exclusively. The plant has horizontal retorts and was active during 1932. The smelters which produced zinc in large quantities in 1932 were the General Smelting Co., Philadelphia, Pa.; Trenton Smelting & Refining Co., Tottenville, N.Y.; Superior Smelting Co., Philadelphia, Pa.; and the Wheeling, W.Va. The secondary smelting & Refining Co. was idle throughout 1932.

Electrolytic plants.—The Anaconda plant of the Anaconda Copper Mining Co. and the East St. Louis plant of the Evans-Wallower Zinc Co. were idle throughout 1932. The Sullivan Mining Co. operated its plant at Kellogg throughout the year at 29 percent of capacity. The Anaconda Copper Mining Co. shut down its Great Falls plant in June 1932 owing to its inability to get zinc concentrates. At the close of the year the rate of electrolytic zinc production in the United States was about 3 percent of rated capacity.

FOREIGN TRADE

Foreign trade of the United States in zinc normally consists largely of imports of zinc ore smelted in bond and exports of slab zinc derived from the foreign ore. Considerable domestic ore was exported before the war and from 1925 to 1927. There is a fairly steady export trade in rolled zinc, zinc dust, and zinc dross and some flow of zinc pigments into and out of the country. During recent years foreign trade has declined to small proportions.

Imports.—The following tables give zinc imports into the United States from 1928 to 1932 and a record of bonded-warehouse inventories.

Zinc ore and old brass (fit only for remanufacture) imported into the United States, 1928-32

(General imports)

Year	Zinc content of zinc ore (short tons)				Old brass	
	Canada	Mexico	Other countries	Total	Short tons	Value
1928 ¹	18	1,648	3	1,667	6,075	\$1,015,177
1929.....	848	13,563	14,411	7,031	1,371,034	
1930.....	13	25,644	182	25,839	3,573	535,761
1931.....	(?)	778	2	780	2,212	215,439
1932.....		1,004		1,004	1,259	\$63,643

¹ Figures probably incomplete.

² Less than 1 ton.

³ Jan.-June 20, 1932. None recorded after June 20.

Zinc remaining in warehouse in the United States, December 31, 1928-32

Year	Ore and calamine		Blocks, pigs, and old		Zinc sheets	
	Zinc content (pounds)	Value	Pounds	Value	Pounds	Value
1928.....	8,719,290	\$797,023				
1929.....	3,758,809	113,479				
1930.....	27,185,311	784,070			43,334	\$2,100
1931.....	22,377,439	260,019	22,900	\$160	71,089	2,800
1932.....	10,211,618	240,338			43,339	2,000

ZINC

Zinc imported for consumption in the United States

Year	Blocks or pigs		Sheets		Old	
	Short tons	Value	Short tons	Value	Short tons	Value
1928.....	(¹)	\$60	3	\$2,550	3	\$200
1929.....	226	21,502	(¹)	62	(¹)	20
1930.....	281	25,389	65	6,420	35	\$1,003
1931.....	274	14,793	20	2,283	(¹)	35
1932.....	310	20,132	39	4,036		

¹ Less than 1 ton.

² Includes 33 tons of dross and skimmings, valued at \$1,320, imported prior to change in tariff.

The chief zinc import of the United States is zinc ore smelted in bond so that it can be reexported without import duty. In 1932, 94 percent of the zinc in ore were imported, an increase over 1931, but only 7 percent of the 1930 imports. Domestic production of any zinc from foreign ore was reported. The United States imports very little slab zinc or manufactured-zinc products. In 1932 the total value was \$35,052, of which \$9,318 represented the value of old brass. A considerable amount of old brass from Canada, which supplied 94 percent of the total, was imported. The decrease in imports in 1932 resulted from the copper tariff on June 21, 1932. After that date no brass were recorded.

Exports.—The total value of the 1932 domestic and foreign manufactures of zinc (including products, alloys, and pigments) was approximately \$1,076,000, an increase of 23 percent from 1931 but a decrease from the recent high in 1925.

The following table shows the principal zinc exports from the United States during the past 5 years:

Domestic zinc ore and domestic manufactures of zinc, 1928-32

Year	Zinc ore and concentrates		Pigs or slabs ¹		Plates and sheets	
	Short tons	Value	Short tons	Value	Short tons	Value
1928.....	4,618	\$205,978	25,289	\$3,013,079	4,325	\$906,515
1929.....	71	2,434	14,411	1,879,039	5,285	1,076,000
1930.....			4,633	450,417	3,808	701,007
1931.....	13	373	643	51,010	2,759	461,130
1932.....			6,471	277,612	3,010	432,849

¹ Includes slab zinc made from foreign ore. Not separately recorded.

Exports of slab zinc in 1932 increased materially owing to increased shipments to Japan, British India, and the British Empire, but were only 8.5 percent of the quantity of sheet zinc also increased in 1932.

shipments to Canada. Exports of these two commodities during the past 4 years are given by destinations in the following table:

Slab and sheet zinc exported from the United States, 1929-32, by destinations, in short tons

Destination	Slabs, blocks, or pigs				Sheets, strips, etc.			
	1929	1930	1931	1932	1929	1930	1931	1932
Countries:								
Canada.....	974	846	7	15	2,124	1,508	1,087	1,497
Chile.....	505	1,115	144	4	20	7	2	2
France.....	2,209				13	34	13	19
Germany.....	1,061	564	79	35	35	20	3	
India (British).....	1,081		112	1,457	340	4	1	
Japan.....	587			3,371	279	194	232	197
United Kingdom.....	4,717	640	235	1,428	1,592	1,193	957	1,029
Others.....	1,627	1,468	66	161	865	908	464	266
	14,411	4,633	643	6,471	5,265	3,868	2,759	3,010
Continents:								
North America.....	1,006	1,077	23	16	2,391	1,776	1,197	1,587
South America.....	626	1,180	145	5	332	314	195	89
Europe.....	10,502	2,350	354	1,611	1,772	1,330	1,021	1,066
Asia.....	2,276	20	121	4,839	726	417	339	261
Africa.....					1	1	1	1
Oceania.....	1				43	30	0	1

Considerable zinc is exported each year in the form of brass and in galvanized iron and steel, but data showing the zinc content of these products are not available. Export data on zinc pigments and chemicals are given in the chapter entitled "Lead and Zinc Pigments and Salts."

WORLD ASPECTS OF THE ZINC INDUSTRY

International (European) zinc cartel.—At the beginning of 1932 the Cartel was functioning under an agreement among virtually all important zinc-smelting countries but the United States. The total producing capacity of the members had been established by agreement at 1,125,000 metric tons of zinc per annum. Production quotas were limited to 50 percent of capacity or approximately 47,000 tons per month. Cartel stocks on January 1, including some non-member stocks, amounted to about 189,000 tons, of which about 80,000 tons were frozen by agreement. During the latter part of 1931 and the first half of 1932 the existence of the Cartel was threatened by abandonment of the gold standard in Great Britain, the imposition of British tariffs on zinc, the demand for tariff protection in Germany, and the demand of some members for increased quotas. The continued decline of the London price of zinc led to agitation for complete cessation of zinc production for 2 months. However, rumors of the impending smash up of the Cartel were dispelled in July by statements in the press to the effect that the Cartel had agreed to continue until January 1, 1933, and that, effective August 1, production would be curtailed an additional 5 percent to 45 percent of the agreed capacity, a monthly output of about 42,000 tons. It was also reported that the Italian members of the Cartel had been permitted to increase production to meet home demands so that Italy might become self-supporting with respect to zinc; as was desired by the Government. In return for this privilege the Italian agreed not to export any metallic zinc.

During the latter part of the year discussion toward extension of the Cartel into the new opinion developed. It was reported that favored by low costs of production were announced in Germany and pressed for larger production. German producers to renew their demand zinc imports into Germany. Other producers requirements of their customers out of current release frozen stocks. On December 28 a proposal reached extending the Cartel for 1 month to Members were to be allowed to exceed their heavy fines for excess production. At the end amounted to about 149,000 tons, a reduction year.

World production.—World production of zinc was 805,000 metric tons in 1932, a decline of 19 percent from the record output of 1929. It but exceeded the 1921 output by 71 percent. In the United States accounted for the largest domestic production having fallen 29 percent for the rest of the world. United States retained zinc producers of the world but by the small 1913. Likewise, its proportion of the world was the lowest since 1898.

Great Britain was the only producer to decline; Norway, Japan, and Italy decreased production; Australia, Germany, Mexico, and declines ranging from 7 to 9 percent; while France accounted for percentage decreases in the United States.

The following table gives production data for countries:

World smelter production of zinc, 1928-32, in metric tons
(Compiled by L. M. Jones, of the Bureau of Mines)

Country	1928	1929
Australia.....	51,029	52,705
Belgium.....	206,300	197,900
Canada.....	74,176	78,061
Czechoslovakia.....	6,039	10,075
France.....	92,463	87,330
Germany.....	98,100	102,000
Great Britain.....	56,281	69,234
India.....	2,887	3,808
Italy.....	10,054	15,804
Japan.....	10,117	22,098
Norway.....	11,220	15,069
Netherlands.....	20,857	25,712
Portugal.....	0,751	12,316
Rhodesia.....		5,510
Spain.....	161,815	100,029
Sweden.....	13,549	11,825
Switzerland.....	6,100	4,718
United States.....	540,049	507,393
Yugoslavia.....	12,246	13,437
Others.....	4,883	6,291
Total.....	1,401,000	1,451,000

Proximate production.—The figures for 1932 are exclusive of secondary material (Metallgesellschaft). The figures for 1928 include secondary material, are as follows: 1928, 104,707 tons; 1929, 104,707 tons. Figures for 1932 not yet available. Ended Sept. 30.

World consumption.—Preliminary data on production, imports, and exports of the principal zinc-consuming countries indicate that world consumption of slab zinc in 1932 totaled about 810,000 metric tons, a decrease of 23 percent from 1931 and of 39 percent from the average of the 5 years 1925 to 1929. This estimate does not consider the decline in stocks outside of the United States and Great Britain, and since it is reported that this decline has been substantial the figure given above probably understates actual consumption.

In consumption, as well as production, the decline was more pronounced in the United States than the rest of the world, as is indicated by the 32 percent decline in domestic deliveries of primary zinc compared with a decrease of about 22 percent elsewhere. Although the United States retained first place in zinc consumption in 1932, its proportion of the total was only 24 percent compared with nearly 39 percent during the 5 years from 1925 to 1929. Germany and Great Britain again ranked second and third but decreased 12 and 21 percent, respectively, in the quantity of zinc consumed. France and Belgium ranked fourth and fifth, respectively, in 1932, the former having declined only 18 percent whereas the latter decreased 45 percent. Consumption in Italy and Japan increased 6 and 7 percent, respectively.

REVIEW BY COUNTRIES

Australia.—Production of zinc was fairly well maintained in Australia during 1932 despite low prices, owing to reduction in wage scales and favorable foreign exchange rates. Smelter production declined only 8 percent. Exports of slab zinc fell from 56,000 long tons to 37,000 tons (34 percent), while shipments of zinc concentrates decreased from 88,000 to 63,000 tons. At the close of the year all four principal Broken Hill operators were producing zinc concentrates, Sulphide Corporation having reopened in April after having been idle since December 1930. North Broken Hill modernized its surface plant and completed a new mill during the year.

Belgium.—In Belgium, production of slab zinc, which is derived almost entirely from imported ores, decreased only 4 percent in 1932. Exports increased from 56,600 metric tons in 1931 to 64,100 tons in 1932. Shipments to Germany increased 28 percent and led to revival of the demand in Germany for tariff protection for the zinc smelters. Consumption, computed on a basis of production plus imports minus exports, declined 45 percent, but this appears to be excessive in view of the smaller decreases in other European countries. Evidently there was considerable liquidation of stocks in 1932, an observation substantiated by press reports that Belgian producers were pressing the cartel for increased production quotas to meet their export trade. During the year Vieille Montagne installed a Waelz plant at Moresnet to treat calamine slimes.

Canada.—Canadian zinc production (all electrolytic) amounted to 86,142 short tons in 1932, a decrease of 27 percent from 1931. Seventy-six percent of the 1932 total was produced at Trail, British Columbia, and 24 percent at Flin Flon, Manitoba. Manitoba increased its output 19 percent in 1932, whereas British Columbia decreased production 35 percent. Exports of slab zinc again exceeded production but were 26 percent below 1931. Shipments to Great Britain decreased 31 percent and were 58 percent of the total, whereas

those to Japan increased 10 percent and were 10 percent of the total. No zinc ore was exported in 1931 and 1932.

Virtually all zinc production in British Columbia is from the Sullivan mine of the Consolidated Mining and Development Co., Ltd. A total of 1,447,448 tons of zinc were produced in 1932, a decrease of 11 percent from 1931. The output was slightly higher and recoveries somewhat lower than in 1931. Costs were of higher grade than in 1931. Costs were lower, notwithstanding the fact that operating capacity was reduced. The company reported a deficit of \$713,000 for depletion and depreciation, compared with a profit of \$713,000 in 1931.

During 1932 the Hudson Bay Mining & Smelting Co., the only zinc producer in Manitoba, mined and produced 1,113,000 pounds of ore averaging 0.085 ounce of gold, 1.13 ounce of silver, and 3.7 percent of zinc from which 933,983 ounces of silver, 21,079 tons of zinc, and 1,113,000 pounds of zinc were produced. All metal produced during the year was reported. An operating profit (before depreciation) of \$713,000 was reported.

France.—Production of zinc decreased 2 percent in 1932. The smelting industry depends largely on foreign zinc. About 47,000 metric tons were imported in 1932, chiefly from Sweden. About 47,000 tons of slab zinc were produced in 1932, supplying 57 percent. Consumption declined 2 percent.

Germany.—The German zinc-mining industry has been aided by Government subsidies to several private companies. A protective policy was adopted to meet the demands of the zinc industry for a protective tariff and to prevent further unemployment. The Government was to advance the production and selling price in the form of a subsidy. No provision was made for custom-smelting. In the latter part of the year they renewed agitation for a protective tariff. It was reported that the Government was considering the Magdeburg electrolytic zinc plant, which was opposed by the sulphuric acid manufacturers on the ground that creation of additional acid facilities for Upper Silesian ore now exported to Germany would demoralize their industry. The Magdeburg plant would provide German with a domestic supply of electrolytic zinc, which is not produced in Germany. Therefore be a logical first step toward ultimate tariff policy. Early in 1933 it was reported that mining companies would be continued under the present imposition of tariffs had been postponed.

Smelter production decreased 7 percent in 1932. Reports indicate a decline of 14 percent in zinc consumption totaled about 133,000 metric tons in 1932, compared with 151,000 tons in 1931. Imports were 102,000 tons in 1932, compared with 102,000 tons in 1931; Poland, Belgium, and Australia were the principal sources.

Great Britain.—Great Britain was the only country to increase production in 1932. Consumption

percent, totaling 116,000 long tons, and imports dropped from 145,000 tons in 1931 to 88,000 tons in 1932. The imposition of a 10 percent import duty on March 1, 1932, was fairly successful in excluding non-British zinc. Canada and Australia supplied 63 percent of the total of slab-zinc imports during 1931 and 87 percent during the last 9 months of 1932.

Italy.—Production, consumption, and imports of zinc in 1932 were maintained at about the same levels as in 1931. Exports of ore, however, declined over 50 percent. The mines of Sardinia operated under subsidies from the Italian Government in 1932, and Monteponi, Pertusola, and Vieille Montagne were the principal recipients. The last named exports its ore to Belgium for smelting. During the latter part of the year Italian smelting companies obtained permission from the Cartel to increase their production to meet home requirements, after agreeing not to export any zinc smelted in Italy.

Mexico.—Mine production of zinc in Mexico in 1932 totaled 57,000 metric tons, a decrease of 52 percent from 1931 and 67 percent from the record output of 1929. This decline may be attributed to unfavorable exchange conditions and to the unprofitable nature, under present conditions, of copper, lead, and silver mining, with which zinc is intimately associated in Mexico. Smelter production declined only 14 percent in 1932.

Newfoundland.—Mine production of zinc was maintained at a high rate despite low metal prices. Approximately 131,000 short tons of zinc concentrates, containing 67,500 tons of zinc and 7,000 tons of lead, and 49,500 tons of lead concentrates, containing 31,000 tons of lead and 5,300 tons of zinc, were produced in 1932 compared with 87,000 tons of zinc concentrates and 38,600 tons of lead concentrates in 1931. Virtually all the output was exported.

Poland.—The zinc industry of Poland experienced another severe decline in 1932. Mine production totaled only 22,000 metric tons, a decrease of 65 percent from 1931 and 82 percent from the record output of 1930. Smelter output declined 35 percent. Polish smelters treat large quantities of imported ores, mostly from German Upper Silesia. A large part of the Polish production of slab zinc is exported. In 1932, 73,000 tons were exported, including nearly 10,000 tons of high-grade (electrolytic) zinc. Germany took about 51 percent of the total and Russia about 11 percent.

Yugoslavia.—Trepca Mines, Ltd., has proved to be one of the few producers able to operate profitably under the low prices prevailing in 1932. During the year ended September 30, 1932, the company treated 397,963 long tons of ore, from which 48,566 tons of 76 percent lead concentrates and 62,192 tons of 50 percent zinc concentrate were obtained. Mill capacity was increased nearly 50 percent during the year. Earnings permitted payment of a 10 percent dividend. Most of the concentrates produced are exported through Salonika.

LEAD AND ZINC PIGMENTS AND

By E. W. PEHRSON AND H. M.

Sales of lead and zinc pigments in 1932 were lessened activity in the pigment-consuming volume of sales in the paint industry, the latter fell 26 percent compared with 1931 due to a drop in building construction. Production of storage batteries, in which large tonnages are used, declined 18 and 14 percent, respectively. A 43 percent decrease in new automobile production in the tire and storage-battery industries might be expected, due to replacements required of old cars still in use. The total registration in the United States declined only 7 percent in 1932. Sales of basic lead sulphate decreased the year 1932, falling 35 percent. Other declines were red lead, 27 percent; zinc oxide, 25 percent; lithopone, 23 percent; and leaded zinc oxide, 23 percent.

Prices of all lead and zinc pigments, as received by producers, decreased further. Important pigments leaded zinc oxide slumped 18 percent; litharge, 18 percent; red lead, 12 percent; dry white lead, 6 percent. Compared with the 5-year average from 1927 to 1931, 1932 represented the following reduction: red lead, 42 percent; dry white lead, 34 percent; zinc oxide, 17 percent; and lithopone, 17 percent. During the same periods the New York quotations for red lead and 54 percent, respectively.

Foreign trade in lead and zinc pigments was affected by a sharp recession in exports of zinc pigments to the United Kingdom and an increase in imports of lead pigments over imports for the United States. Exports compared with \$2,539,000 in 1930, due to a drop in consumption throughout the world, was attributed more particularly to Canada's importation of lead pigments from the United Kingdom, enabling it to become an exporter of that commodity. Another factor that influenced effect in 1933 is the increase in preference for lead pigments, established by Canada in 1932.

Sales of zinc chloride and zinc sulphate were 10 percent, respectively, in 1932.

Lead 700,000 sold by domestic manufacturers in the United States, 1931-32

Pigment	1931				1932			
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)			
		Total	Average		Total	Average		
Basic lead sulphate or sublimed lead:								
White.....	8,700	\$995,685	\$113	5,708	\$534,369	\$94	82	
Blue.....	896	90,785	101	540	34,125	62	111	
Red lead.....	25,853	3,325,875	129	18,880	2,101,860	111	178	
Orange mineral.....	282	55,254	196	212	37,691	89	101	
Litharge.....	63,890	6,033,241	109	68,096	5,155,555	89	101	
White lead:								
Dry.....	30,922	3,824,813	124	19,916	2,320,870	117	191	
In oil.....	60,446	13,902,787	209	40,728	8,939,422	191	191	

¹ Weight of white lead only but value of paste.

Zinc pigments and salts.—Although the production of lithopone has been greatly reduced during the depression it has not fared as badly as the other principal white pigments. The 1932 output of lithopone was 20 percent below that in 1931 and 41 percent below the predepression peak, whereas that of zinc oxide fell 25 percent and 55 percent and that of white lead 32 and 66 percent for the same periods. This was not accomplished by price reductions, as lithopone producers reported smaller decreases in unit values than have white lead and zinc oxide producers.

Production of zinc chloride and zinc sulphate dropped 33 and 20 percent, respectively. The average value per ton received by zinc chloride producers increased 7 percent, whereas that received by zinc sulphate producers declined 13 percent.

Production and value of zinc pigments and salts sold by domestic manufacturers in the United States, 1931-32

Pigment or salt	1931			1932		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide 1	95,700	\$11,997,990	\$125	72,250	\$7,950,697	\$110
Leaded zinc oxide 1	18,577	2,140,864	115	14,305	1,296,076	90
Lithopone	151,850	12,999,590	86	121,667	10,176,858	84
Zinc chloride, 50° B.	34,885	1,117,010	41	23,524	1,033,255	44
Zinc sulphate	5,290	199,482	38	4,252	138,476	33

¹ Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide.

CONSUMPTION BY INDUSTRIES

White lead.—By far the principal use of white lead is in the manufacture of paint, which accounted for 95 percent of the total consumption in 1932. The tonnage used in 1932 was 31 percent below that in 1931 and 54 percent below 1929. Consumption of white lead in the ceramic industry decreased 38 percent in 1932.

LEAD AND ZINC PIGMENTS AND ZINC

Distribution of white lead (dry and in oil) sales, 1929-1932

Industry	1929		1930		Short tons
	Short tons	Percent of total	Short tons	Percent of total	
Paint.....	136,520	92.8	91,603	89.6	91,800
Ceramics.....	4,240	2.9	3,300	3.3	2,800
Other.....	6,259	4.3	7,211	7.1	2,600
	147,031	100.0	102,140	100.0	97,300

Basic lead sulphate.—Consumption of basic lead sulphate in 1932 was 32 percent below that in 1931 and 92 percent below 1929. The use of this pigment in paint was lumped 92 percent since 1929. The white variety is used in the lead pigments, and the blue variety is said to be used in paints used as protective coatings on metallic surfaces.

Distribution of basic lead sulphate sales, 1929-1932

Industry	1929		1930		Short tons
	Short tons	Percent of total	Short tons	Percent of total	
Paints.....	13,435	79.9	9,573	83.0	8,310
Storage batteries.....	2,327	13.8	1,104	9.6	890
Rubber.....	656	3.9	394	3.4	170
Other.....	397	2.4	456	4.0	50
	16,814	100.0	11,527	100.0	9,980

Litharge.—The principal use of litharge is in the manufacture of storage-battery plates. Sales to this industry in 1932 and were equivalent to 79 percent of the total. Sales to the insecticide industry, the second largest user, increased steadily during the past few years due to the use of lead arsenate in the spraying of fruit trees. The Department of Agriculture cutting down the use of lead arsenate may adversely affect the demand for litharge. The sales of litharge to the oil-refining industry dropped steadily since 1929 as shown in the following table. Grades of raw materials are now being used in the oil-refining process, requiring less litharge. Moreover some plants have been installed which are using the litharge formerly discarded.

Distribution of litharge sales, 1929-32, by industries

Industry	1929		1930		1931		1932	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Storage batteries.....	37,160	42.2	33,173	45.7	31,605	49.5	29,365	60.6
Insecticides.....	(1)	(1)	6,000	8.3	7,508	11.8	11,735	20.2
Oil refining.....	13,015	15.6	12,028	16.6	7,351	11.5	4,793	8.3
Ceramics.....	8,663	9.8	4,089	5.6	4,124	6.5	2,963	5.1
Chrome pigments.....	8,112	9.2	3,289	4.5	3,582	5.6	2,501	4.6
Rubber.....	6,651	7.6	4,736	6.5	3,032	4.7	1,021	3.3
Varnish.....	3,124	3.6	688	1.0	641	1.0	1,360	2.8
Linoleum.....	322	.4	388	.5	208	.3	169	.3
Other.....	10,269	11.7	8,180	11.3	5,839	9.1	3,199	5.5
	87,916	100.0	72,578	100.0	63,890	100.0	58,006	100.0

(1) Included in other. Not separately reported.

Red lead.—In 1932, 22 percent less red lead was used in storage batteries than in 1931 and 59 percent less than in 1929. Compared with litharge red lead has decreased relatively more in this important use. For several years battery manufacturers have been employing smaller portions of red lead in the paste that forms the battery plate. As red lead costs more than litharge this trend probably has been accelerated during the depression to reduce costs of production and meet the lower scale of storage-battery prices. It is believed that some manufacturers are substituting for red lead a substance referred to as active lead or suboxide of lead. Red lead continues to be the most effective protective paint for iron and steel, and the sharp recession in its use in paint manufacture reflects the low level of building construction.

Distribution of red-lead sales, 1929-32, by industries

Industry	1929		1930		1931		1932	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Storage batteries.....	25,680	59.7	18,008	57.7	13,700	53.0	10,655	26.0
Paints.....	11,855	27.0	10,009	31.1	9,256	35.8	6,380	15.7
Ceramics.....	903	2.1	835	2.6	811	3.1	467	2.1
Other.....	4,574	10.6	2,202	6.7	2,086	8.1	1,369	7.2
	43,021	100.0	32,041	100.0	25,853	100.0	18,860	100.0

Orange mineral.—Sales of orange mineral declined 25 percent in 1932, the major decrease being in ink manufacture.

Distribution of orange-mineral sales, 1929-32, by industries

Industry	1929		1930		1931		1932	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Ink manufacture.....	151	22.3	88	24.7	119	42.2	58	21.0
Color pigments.....	487	71.8	188	52.8	114	40.4	108	39.0
Other.....	40	5.9	80	22.5	49	17.4	46	21.0
	678	100.0	356	100.0	282	100.0	212	100.0

Zinc oxide and leaded zinc oxide.—Owing to a manufacturer to segregate its sales of the zinc oxide, the Bureau of Mines is unable to report the consumption by industry. The most recent source of data on the consumption of zinc oxide in the rubber industry is the Census of Manufactures for 1929. According to this report 66,838 tons of zinc oxide were used in the manufacture of rubber goods in 1929, or 42 percent of the total reported by domestic producers.

The most recent source of data on the consumption of zinc oxide in the rubber industry is the Census of Manufactures for 1929. According to this report 66,838 tons of zinc oxide were used in the manufacture of rubber goods in 1929, or 42 percent of the total reported by domestic producers. Three percent of the total was used in the manufacture of inner tubes, 4 percent in rubber boots and shoes, and 3 percent in miscellaneous rubber goods. The data indicate that the zinc oxide content of all rubber goods is about 6 percent.

According to the Census of Manufactures for 1929, the rubber industry consumed 55,603 tons of zinc oxide in that year. This probably includes leaded zinc oxide also; thus, the total consumption of zinc oxide in the rubber industry is about 66,838 tons, or 30 percent of the total sales of zinc oxide and leaded zinc oxide reported to the Bureau of Mines for 1929.

Lithopone.—Increasing use of lithopone and zinc pigments in the paper industry is indicated by reports from the Laboratory and preliminary plant tests. These pigments give to paper increased opacity, brightness and a superior printing surface. In addition, the properties of the zinc pigments aid in keeping the paper from becoming discolored by the formation of troublesome slime in paper mills.

Sales of lithopone to the paint industry were 19 percent less in 1932 than in 1931 and 38 percent below 1929. Sales to the textile industry took 15 percent less in 1932 than in 1931 and less than in 1929, and sales to the rubber industry were 19 percent below 1931 and 45 percent below 1929.

Lithopone producers reported the use of about 4,000 tons in the manufacture of titanated lithopone in 1931. Sales of high-strength lithopone were up slightly better than of ordinary lithopone.

Distribution of lithopone sales, 1928-32, by industries

Industry	1928 (short tons)	1929 (short tons)	1930 (short tons)	1931 (short tons)	1932 (short tons)
Paints, etc.....	149,122	150,804	126,076	126,076	126,076
Floor coverings and textiles.....	36,416	37,506	23,658	23,658	23,658
Rubber.....	6,898	7,176	6,997	6,997	6,997
Other.....	9,032	10,829	8,336	8,336	8,336
	200,468	206,315	164,067	164,067	164,067

Zinc chloride.—The principal use of zinc chloride is as a preservative, and statistics indicate that it is used in this field. According to the Department of the Interior, the consumption of zinc chloride by wood-treating was about 8,000 tons in 1909 to a peak of nearly 12,000 tons in 1913. Since then it has dropped to about 12,000 tons in 1931. Meanwhile, the consumption of zinc chloride in the manufacture of zinc chloride has increased from about 12,000 tons in 1913 to about 12,000 tons in 1931.

from 51,000,000 gallons to a peak of 226,000,000 gallons in 1929. The consumption of creosote in 1931 was 30 percent below that of 1928, whereas that of zinc chloride fell 56 percent.

Zinc sulphate.—Sales of zinc sulphate decreased 20 percent in 1932. One principal use of zinc sulphate is as a depressant in the flotation of lead-zinc ores. In 1929, 1,425 tons were so used, but only 1,063 tons were used in 1930 and 509 tons in 1931.

RAW MATERIALS USED IN THE MANUFACTURE OF LEAD AND ZINC PIGMENTS AND SALTS

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and miscellaneous secondary materials, such as scrap and waste, from various industrial processes. In 1932, 96.1 percent of the lead in lead pigments was derived from pig lead, 3.7 percent from ore, and 0.2 percent from secondary material. For zinc pigments the proportions were 59.3 percent from ore, 21.4 percent from slab zinc, and 19.3 percent from secondary materials.

Metal content of lead pigments and zinc pigments and salts produced by domestic manufacturers, 1931-32, by sources, in short tons

Source	1931		1932	
	Lead in pigments ¹	Zinc in pigments and salts	Lead in pigments ¹	Zinc in pigments and salts
Domestic ore.....	5,722	74,532	4,932	54,932
Metal.....	166,328	26,223	127,318	19,833
Secondary material ²	710	22,799	292	17,869
	172,760	123,554	132,512	92,634

¹ Includes also lead recovered in zinc oxide and leaded zinc oxide. The metal content of lead acetate and lead arsenate is not available as no canvass of their production is made by the Bureau of Mines. Moreover, these salts are derived from pig lead, and their metal content has already been taken into statistical account in the figures covering lead production.

² Zinc ashes, skimmings, drosses, and old metal.

In the following tables the source of the metal used in the manufacture of each pigment and salt is given. Pig lead is used exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and to a large extent in the manufacture of basic lead sulphate. Zinc oxide is the only pigment in which considerable quantities of slab zinc are used. Ore is employed in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulphate, and basic lead sulphate. Some secondary lead is used in the manufacture of basic lead sulphate, and a substantial proportion of the zinc in lithopone and zinc chloride made in the United States is derived from secondary material.

LEAD AND ZINC PIGMENTS

Lead content of lead and zinc pigments produced in 1932, by sources, in short tons

Pigment	1931			Total lead in pigments
	Lead in pigments produced from—			
	Domestic ore	Pig lead	Secondary material	
White lead.....		78, 374		78, 374
Red lead.....		23, 005		23, 005
Litharge.....		60, 446		60, 446
Orange mineral.....		250		250
Basic lead sulphate.....	1, 901	4, 247	509	6, 657
Leaded zinc oxide.....	3, 821		141	3, 962
Zinc oxide.....				
	5, 722	166, 328	710	172, 760

Zinc content of zinc pigments and salts produced in 1932, by sources, in short tons

Pigment or salt	1931			Total zinc in pigments and salts
	Zinc in pigments and salts produced from—			
	Domestic ore	Slab zinc	Secondary material	
Zinc oxide.....	47,460	26,136	45	73,641
Leaded zinc oxide.....	8,997		540	9,537
Lithopone.....	17,487		15,111	32,598
Zinc chloride.....		67	6,351	6,418
Zinc sulphate.....	588	20	746	1,354
	74,532	26,223	22,799	123,554

¹ Includes zinc content of a small quantity of zinc sulphide.

PRODUCERS AND

A list of the producers of the various zinc salts was given on page 220 of Minerals Yearbook, 1931, part I. During 1932 it was noted that the Picher Lead Co. added 10 litharge furnaces to the total of 16. Early in 1933 it was stated that the Co. was constructing a 50-ton mill near the new process for making zinc oxide with the group (Copperconda Mines Co.) that closed its plant at Santa Ana, Calif., in 1932.

The Ozark Smelting & Mining Co., Williams Co., began producing zinc sulphate at Coffeyville, Kans.

PRICES

The total value and the average price received by producers from sales of lead and zinc pigments and salts are stated earlier in this chapter. The range of market quotations as reported by the Oil, Paint and Drug Reporter appear in the following table:

Range of quotations on lead pigments and zinc pigments and salts at New York, 1930-32, in cents per pound

Product	1930	1931	1932 ¹
Basic lead sulphate, or sublimed lead, dry, casks.....	6.75-7.75	6.00-6.75	5.50-6.00
White lead, or basic lead carbonate:			
Dry, casks.....	7.25-8.25	6.50-7.25	6.00-6.50
In oil, carload lots.....	10.09-11.54	9.33-10.30	(2)
Litharge, American, commercial, powdered, casks.....	7.75-8.75	5.75-7.75	5.25-6.00
Red lead, dry, casks.....	8.75-9.75	6.75-8.75	6.25-7.00
Orange mineral, American, casks.....	10.75-11.75	9.50-10.75	8.75-10.75
Lead acetate, brown, broken, barrels ¹	10.50-13.00	10.00-10.50	9.00-10.50
Lead arsenate, powdered, drums ¹	13.00-16.00	10.00-16.00	9.50-14.00
Zinc oxide:			
American process, lead-free, bags, car lots.....	6.50	6.50	³ 5.75-6.50
American process, leaded, barrels, car lots.....	6.50	6.50	³ 5.75-6.50
French process, red seal, bags, car lots.....	9.38	9.38	³ 8.63-9.75
French process, green seal, bags, car lots.....	10.38	10.38	³ 9.63-10.38
French process, white seal, barrels, car lots.....	11.63	11.63	³ 10.88-11.63
Lithopone, American, bags, car lots.....	4.50-5.25	4.50	³ 4.50
Zinc sulphide, 500-pound barrels.....	10.00-32.00	13.00-10.50	13.00-13.00
Zinc chloride:			
Solution, ⁴ tanks.....	2.25-3.50	2.25-3.00	3.00
Fused.....	5.75	5.00-5.75	5.00-5.75
Zinc sulphate, crystals, barrels ¹	3.00-3.50	3.00-3.50	3.00-3.50

¹ Compiled from weekly reports.

² Figures not available.

³ Beginning with June 4, 1932, recorded as 2-ton lots.

⁴ At works.

Quotations for white lead and basic lead sulphate were steady up to the latter part of December, when a decrease of one half cent per pound was announced. The lead oxides fluctuated more, following the trend of pig-lead prices more closely. Quotations were maintained at the level of the beginning of the year until the middle of July, when a drop of one half cent was recorded. During August three successive rises of one fourth cent each brought quotations above the opening, but this was followed by a 1/2-cent drop the first of October. A week later quotations again rose one fourth cent, where they remained until another 1/4-cent cut was announced the last of December. At the close of the year oxide quotations were one fourth cent below those at the first of the year.

Zinc oxide quotations were reduced three fourths cent per pound below the year's opening levels about the middle of March and held at these levels for the rest of the year. Early in June, however, further concessions were made by reducing the tonnage requirements from carload lots to 2-ton lots. The quotation for lithopone was maintained at 4.50 cents, but the basis was changed from carload to 2-ton lots early in June.

FOREIGN TRADE

The United States continued to have an export balance in its foreign trade in lead and zinc pigments and salts in 1932. Exports were valued at \$974,253 and imports at \$592,245, leaving an export balance

of about \$382,000 compared with \$1,546,000 in 1929. In 1929 exports were valued at \$4,551,198,000. Zinc pigments and salts accounted for 91 percent of the exports and 91 percent of the imports in 1932.

The following table shows the value of the salts imported and exported in 1931-32:

Value of foreign trade of the United States in lead and zinc pigments and salts, 1931-32

	1931	
	Imports	Exports
Lead pigments:		
White lead.....	\$12,114	5
Red lead.....	44	1
Litharge.....	48	
Orange mineral.....	1,037	
Total.....	14,143	
Zinc pigments:		
Zinc oxide.....	180,477	
Lithopone.....	428,523	
Zinc sulphide.....	16,500	
Total.....	634,500	1
Lead and zinc salts:		
Lead arsenate.....		
All lead compounds ¹	47,390	
Zinc chloride.....	20,868	
Zinc sulphate.....	7,248	
All zinc compounds ²		
Total.....	75,506	
Grand total.....	724,230	2

¹ Red lead includes litharge and orange mineral.

² Red lead includes orange mineral.

³ Excluding pigments. Salts not classified separately.

Lead pigments and salts.—Imports of lead pigments and salts were negligible proportions. The most important lead compounds including lead acetate, lead nitrate, and lead sulphate.

Lead pigments and salts imported for consumption in the United States, in short tons

Year	Basic carbonate white lead	Red lead	Litharge
1928.....	83	12	
1929.....	98	6	
1930.....	74	10	(1)
1931.....	68	(1)	(1)
1932.....	20	4	

¹ Less than 1 ton.

The principal exports are white lead, litharge, and lead arsenate, all of which decreased sharply in 1932. Litharge, and red lead each amounted to less than 1 percent of the domestic production of each of these pigments in 1932. Exports of white lead to foreign countries decreased 66 per

the drop in exports to the United Kingdom. Exports of red lead and litharge fell 36 percent, as our principal customer, Canada, took 34 percent less than in 1931.

Lead pigments and salts exported from the United States, 1928-32, in short tons

Year	White lead	Red lead ¹	Litharge	Lead arsenate	Other lead compounds	Total value
1928	6,476	2,084	(?)	547	102	\$1,501,950
1929	5,908	2,800	(?)	782		1,616,937
1930	6,546	4,128	(?)	1,135		1,777,169
1931	5,008	3,087	(?)	804		1,123,369
1932	1,681	493	1,403	595		401,694

¹ Includes litharge from 1928 to 1931 and an unknown quantity of orange mineral, 1928 to 1932.

² Included with red lead.

White lead and red lead, orange mineral, and litharge exported from the United States, by destinations, 1928-32, in short tons

Destination	White lead				Red lead, orange mineral, and litharge			
	1928	1929	1931	1932	1928	1930	1931	1932
Countries:								
Argentina	400	434	67	31	25	95	103	63
Canada	122	86	81	23	1,545	1,604	1,935	1,268
Netherlands	532	257	361	387		58	37	4
Netherland West Indies	2	3	1	3	12	901	(?)	3
Panama	568	101	1	201	77	70	70	2
Philippine Islands	228	380	112	145	133	144	86	105
United Kingdom	3,382	4,750	4,235	743	169	442	233	26
Others	674	555	150	148	720	804	617	515
Total	5,908	6,546	5,008	1,081	2,800	4,128	3,087	1,986
Continents:								
North America	940	388	152	326	2,100	2,814	2,117	1,379
South America	495	575	83	75	196	199	223	218
Europe	3,037	5,075	4,619	1,131	227	701	490	197
Asia	404	484	123	148	213	300	217	170
Africa	5	8	30	(?)	1	7	40	21
Oceania	30	16	1	1	153	107	(?)	1

¹ Less than 1 ton.

Zinc pigments and salts.—For the first time in several years the value of zinc pigments and salts imported exceeded that exported—a result of a sharp decline in exports of zinc oxide and zinc salts and a substantial increase in imports of zinc oxide. Lithopone continued to be the most important zinc import both in tonnage and value notwithstanding a 17 percent drop in tonnage. Imports of zinc oxide (dry) increased 86 percent in quantity. Nearly all the zinc pigments imported in 1932 came from Europe. The Netherlands supplied 56 percent, Germany 1 percent, and Belgium 43 percent of the lithopone. Imports of zinc oxide originated as follows: Belgium, 24 percent; France, 12 percent; United Kingdom, 55 percent; Germany, 4 percent; and other countries, 5 percent. Most of the 1932 increase was derived from the United Kingdom.

Zinc pigments and salts imported for consumption in short tons

Year	Zinc oxide		Lithopone	Total value
	Dry	In oil		
1928	1,348	107	0,885	
1929	1,207	110	8,409	
1930	1,056	79	7,015	
1931	1,352	105	6,074	
1932	2,515	157	4,724	

Exports of lithopone, zinc oxide, and zinc salts were 75, and 70 percent in quantity, respectively, in 1932. The value of the three commodities declined 5 percent. The United Kingdom continued as the principal importer of zinc oxide, but shipments of lithopone declined 74 percent. Canada increased its imports of zinc oxide 91 percent, and the Netherlands 91 percent, respectively, in 1932. Shipments of zinc oxide to the United Kingdom declined 94 percent in 1932. Owing to the decline in exports of zinc oxide at home the United Kingdom is now importing to an exporting nation in this commodity.

Zinc pigments and salts exported from the United States, by destinations, 1928-32, in short tons

Year	Zinc oxide	Lithopone	Zinc salts	Total value	Year	Total value
1928	14,700	3,326	1,688	\$2,338,064	1931	
1929	17,638	4,556	1,711	2,019,140	1932	
1930	10,753	3,065	1,558	1,956,085		

Zinc oxide and lithopone exported from the United States, by destinations, 1928-32, in short tons

Destination	Zinc oxide				Lithopone	Total value
	1928	1929	1931	1932		
Countries:						
Argentina	24	68	171			
Canada	7,702	4,547	2,818			
Cuba	117	91	58			
France	452	428	1			
United Kingdom	6,360	4,719	1,523			
Others	2,983	900	500			
Total	17,638	10,753	5,131	1		
Continents:						
North America	7,907	4,812	2,998			
South America	69	105	217			
Europe	8,025	5,378	1,713			
Asia	607	176	93			
Africa	3	14	8			
Oceania	637	208	102			

¹ Less than 1 ton.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA, UTAH, AND WASH.

By C. N. GERRY AND PAUL LU

ARIZONA

The value of the gold, silver, copper, and lead in Arizona in 1932 was \$13,172,871, a marked decrease from \$16,694 in 1931. The decrease in the value of the copper was more than \$25,000,000, and there were a corresponding decrease in the values of the gold and silver productions. The value of the copper in 1932 was slightly more than that in 1931, on account of the decline in the average price of copper from mines in Arizona in 1931 or 1932.

The average price of copper in 1932 (6.1 cents) was less than any annual average price from 1850 to 1931. The closing of several mines producing copper ore and the closing of operators in the last decade. After the Phelps Dodge Corp. absorbed the smelting and mining assets of the Copper Queen Mining Co. on October 1, 1931 the Copper Queen was closed, and in 1932 the Phelps Dodge Corp. closed its adjoining smelter formerly used by the Calumet and Hecla Mining Co. The Phelps Dodge Corporation closed its branch in April 1932, and the Morenci branch of the Phelps Dodge Corp. closed its mine and mill at Miami. The Inspiration Consolidated Copper Co. closed its mine and concentrator on May 9. The closing of the Phelps Dodge National Smelting Co. at Miami. The mine and branch of the Nevada Consolidated Copper Co. closed continuously in 1932, but at a greatly reduced rate. The smelter of the American Smelting & Refining Co. operated intermittently on concentrates from the Nevada Consolidated Copper Co. at Hayden and on crude ore and concentrates from the Phelps Dodge operators. The mine, mill, and smelter of the Phelps Dodge Superior, Pinal County, were closed in June. The United Verde Copper Co. at Clarkdale closed its branch for the year. The United Verde Extension closed its branch for the year. The United Verde Extension did not only operated its mine at Jerome and its branch for the year but increased its output of gold. Only 3 of the 9 copper smelters in Arizona were operating for the year. In normal times Arizona produces about one-third of the total copper production of the United States. On account of the general decrease in the copper production of Arizona, and Michigan, the ratio in 1932 was close to normal times.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1928-32, in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons		Fine ounces	Pounds	Pounds	Pounds	
1928	22,828,766	\$3,967,488	6,791,351	732,276,803	14,389,964	1,278,636	\$114,300,381
1929	25,860,772	4,182,287	7,543,283	830,628,411	16,054,122	2,458,580	155,607,133
1930	10,802,919	3,501,610	5,540,732	576,190,607	8,491,623	1,630,506	81,042,418
1931	13,690,610	2,608,495	3,245,311	401,344,909	1,064,112		40,144,694
1932 ¹	4,455,000	1,319,600	2,057,000	183,887,000	2,000,000		13,172,871

¹ Subject to revision.

Gold.—The gold output in 1932 decreased about 50 percent from that in 1931 due to drastic curtailment in the mining of copper ore and to the decreased output of gold ore from the Tom Reed and other mines near Oatman, Mohave County. In 1932 the output of gold in Arizona was less than half that of any other year except 1908, since detailed records were started in 1903. An exceptionally large decrease was recorded in the production of gold from the Tom Reed mine, and marked declines were also recorded from the properties of the Phelps Dodge Corporation, United Verde Copper Co., and Magma Copper Co. A large increase, however, was reported from the United Verde Extension mine at Jerome, Yavapai County. The United Verde mine, also at Jerome, the largest producer of gold in Arizona from 1924 to 1930, was idle in 1932, as were the mill and smelter at Clarkdale.

There was a decided increase in the production of gold from placer operations, particularly from Copper Basin, Big Bug Creek, Lynx Creek, and Octave in Yavapai County, Greaterville in Pima County, Dome and Quartzsite in Yuma County, San Francisco River in Greenlee County, and Gold Basin in Mohave County. There was also considerable activity in gold mining at lode mines in the Doa Cabezas district in Cochise County; Vulture district in Maricopa County; Weaver district in Mohave County; Arivaca, Cababi, and Quijotoa districts in Pima County; Old Hat district in Pinal County; Oro Blanco district in Santa Cruz County; Black Canyon, Cherry Creek, Hassayampa, and Weaver districts in Yavapai County; and Ellsworth district in Yuma County. The Copper Queen branch of the Phelps Dodge Corporation was by far the largest producer of gold in Arizona in 1932; it was followed in order by the United Verde Extension, Magma, Tom Reed, New Cornelia, and Katherine properties.

Silver.—The silver output in Arizona in 1932 decreased 1,188,311 ounces from the output in 1931, and the value from \$941,140 to \$580,074. Most of the silver, as well as a majority of the gold produced in Arizona, is recovered from copper ore. Since there was an unusual decrease in the output of copper material in 1932 there was a decided decline in the production of both silver and gold. In 1932 the output of silver in Arizona was the smallest since detailed records were started, and the average price (28.2 cents an ounce) was less than that of any year since 1850. The largest decrease in silver output was reported from the properties of the Phelps Dodge Corporation. The inactivity at the United Verde mine, the largest silver producer in

Arizona from 1923 to 1930, resulted in a large decrease in output, and there was also a large decrease in the output of silver from the Copper Queen branch of the Phelps Dodge Corporation. The Copper Queen branch of the Phelps Dodge Corporation was the leading producer of silver in Arizona in 1931, followed by the Magma and United Verde mines.

Copper.—In 1932 Arizona was again the leading producer of copper in the United States, but its output decreased about 10 percent from output in 1931, and the value decreased from \$114,300,381 to \$13,172,871. The average price of copper in 1932 was 9.1 cents a pound, compared with 9.1 cents a pound in 1931 and an unusually low price in 1932 resulted in the large producers of copper, some of which had been in operation for 30 years. The value of the output was nearly 70 percent less than that in 1931, 80 percent less than in 1930, and less than one fourth of the value of 1929. The United Verde Extension Mining Co. was the largest copper producer in Arizona which increased its output in 1932, but the output was considerably less than in 1931. The largest decrease was reported by the Copper Queen branch of the Phelps Dodge Corporation, followed closely by the Tombstone Extension property. Other large decreases were reported from the Dominion mines in Gila County, the New Cornelia mine in the United Verde in Yavapai County, Greenlee County, and the Magma and Roubidoux mines. The largest copper producers in 1932 were the United Verde Extension, Morenci, Magma, Miami, and New Cornelia properties.

Lead.—The lead production in Arizona decreased about 10 percent over the production in 1931, but the value increased from \$56,000 to \$58,000, as the average price of lead decreased from 2.8 cents a pound in 1931 to 2.8 cents in 1932.

Nearly all the large producing lead mines in Arizona were in operation in 1932, which resulted in an output less than that in 1931. Almost all the lead ore or concentrates were smelted at El Paso, Tex., as the lead from the Tombstone Extension property at Tombstone, Ariz., was shipped to the producer of lead in Arizona in 1932, and it was smelted at the Copper Queen branch of the Phelps Dodge Corporation. The Tombstone Extension property at Tombstone, Ariz., was the largest producer of lead in Arizona in 1932, and it was followed in order by the Eagle-Picher Lead Co. mine in Yavapai County, and the 79 mine at Hayden Junction, Ariz., which produced nearly 2,000,000 pounds of lead both in 1931 and in 1932. The increases from the Tombstone Extension property and from the Copper Queen branch of the Phelps Dodge Corporation in 1932 offset the decrease in output from the Reel, Grand Central tailings dump, and smelter at Tombstone.

Zinc.—No zinc was recovered from ore in Arizona in 1931 or 1932.

Review of districts and operations.—The producing districts of Arizona are Bisbee, Cochise County; and Jerome, Yavapai County. The output of copper from the Warren district in 1931 was 1,186,213 pounds of copper precipitates, yielded \$731,888 in value, 95,327,922 pounds of copper, and valued in all at \$9,805,074, a decrease of \$8,000,000 from 1931.

the output in 1930. The chief producers in the district in 1931 were the Copper Queen and Calumet and Arizona mines. In 1932 the output of the district was again distinctly decreased, and the only operator worthy of note was the Copper Queen branch of the Phelps Dodge Corporation. The output of copper from this property in 1932 was less than half that in 1931, and there was also a decrease in the output of gold and silver, but the output of lead increased. The property, however, was the largest producer of gold, silver, and copper in Arizona. In 1932 about 260,000 tons of ore, chiefly copper material, were produced from the district, which yielded gold, silver, copper, and lead valued at about \$3,755,000.

The production of the Globe district in 1931 was 7,429,571 tons of ore and old tailings (chiefly copper ore), \$50,869 in gold, 77,670 ounces of silver, 126,443,616 pounds of copper, and 47,065 pounds of lead, valued in all at \$11,581,503, a decrease of \$9,121,253 from the value of the output in 1930. In 1932 the output of ore in the Globe district was less than one third the output in 1931, as the two chief producers closed in May. The Miami mine was the largest producer of copper in the district in 1932, and the Inspiration mine was second. The Old Dominion mine, a large producer of copper ore for the last 40 years, was closed October 14, 1931, and the mine was permitted to fill with water to the twelfth level. According to the printed annual report of the Miami Copper Co. for 1932, 1,417,810 tons of ore containing 0.774 percent copper were milled during the first 4½ months of the year. Although operating costs were reduced to 6.64 cents per pound of copper, the price was too low to permit further operation. The construction of a new plant to treat 3,000 tons of tailings a day was completed, and it was put in operation in August. This plant operated intermittently until February 8, 1933, when the entire property was closed. On January 1, 1933, the estimated ore reserves consisted of 78,527,502 tons of sulphide ore containing 0.88 percent copper and 6,911,678 tons of mixed ore containing 1.83 percent copper. In 1932 the cost of mining per pound of copper was 3.08 cents, the cost of milling was 2.26 cents, and general costs 1.30 cents, a total cost of 6.64 cents.

According to the printed annual report of the Inspiration Consolidated Copper Co. for 1932, operations began at the property on June 29, 1915, and from this date to the end of 1932, 72,392,583 tons of ore were treated, which yielded 1,328,566,121 pounds of copper. The ore reserves on December 31, 1932, consisted of 41,217,769 tons of milling ore containing 1.438 percent copper and 27,793,001 tons of mixed ore containing 1.276 percent copper. The property is fully equipped to produce 130,000,000 pounds of copper annually. The mill treated 4,092 tons of sulphide ore by flotation in 1932, which yielded 124,785 pounds of copper; 537,929 tons of ore were leached, which yielded 11,061,682 pounds of copper; 28,029 tons of slimes from the leaching plant were concentrated by flotation, which yielded 172,311 pounds of copper; and 667,403 pounds of copper were recovered from slimes leached, a total production of 12,026,181 pounds of copper for the year compared with 61,368,033 pounds in 1931. The combined extraction of ore and slimes treated in 1932 was 88.926 percent of the total copper, and the cost of producing fine copper, including depreciation, but excluding depletion and Federal taxes, was 9.907 cents a pound compared with 8.429 cents a pound in 1931.

The value of the output of the Verde district in 1932 was \$1,100,000. The output consisted of copper ore chiefly from the Verde Extension and United Verde mines. From the Verde mine was the largest producer of silver in the same period, with the exception of 1923, and the second largest producer of gold in Arizona; and with the exception of 1923, the largest producer of copper. In May 1931 the Verde Extension mine was closed, resulting in an unusual decrease in the output of the district in 1931-32. The United Verde mine was an important producer in the district in 1932, and its output was over that in 1931. According to the company's printed annual report for 1932, 212,241 tons of ore and concentrates were milled, which yielded 10,007 ounces of gold, 348,247 ounces of silver, and 1,348,247 pounds of copper. The mine ranked second in the production of copper in Arizona in 1932 and third in the production of producing 1 pound of copper was 5.45 cents. The end of 1932 are estimated to be 360,000 tons of ore, and regular quarterly dividends during the year.

The Mineral Creek and Pioneer districts in the Globe district in Pima County, and the Copper Queen mine in Pinal County are also large copper-producing mines of the Nevada Consolidated Copper Co. The Nevada Consolidated Copper Co. district, Pinal County, were operated near the Verde mine. The 12,000-ton flotation concentrator at Hayden, Arizona. The ore output in 1932 was less than half that in 1931. The production decreased nearly 40 percent. The company produced 5,151.72 ounces of gold, 486,037 ounces of silver, and 7,085,107 pounds of copper from 12,000 tons of ore containing 6.90 percent copper. The output of the Verde mine in 1932 by table and flotation concentrator was 86,000 tons of first-class copper ore, were produced from the Verde Extension mine and 15,000-ton flotation concentrator. The Verde mine, Pima County, was operated by the Phelps Dodge Corporation in April, when all work ceased. The production of the Verde mine in 1932 was about one fourth that in 1931, and there was a decrease in the production of gold and silver. The Phelps Dodge Corporation in the Copper Queen mine, Pinal County, was operated until July, when all work ceased. The property is equipped with a 12,000-ton flotation concentrator and a 500-ton smelter. Although the output in 1932 was about 15,000,000 pounds less than in 1931, the property ranked third as a producer of copper.

IDAHO

The value of the gold, silver, copper, lead, and zinc produced from mines in Idaho in 1932 decreased about 34 percent from 1931. The largest decrease was in lead, by far the most important metal produced in the State. The production in 1932 was the smallest since 1902 and was valued at about \$3,976,000 compared with \$7,352,981 in 1931. There were also decreases in the output of zinc, silver, and copper, but the output of gold was the largest since 1916 and was more than double the output in 1931. Smelting and refining operations at the lead plant at Kellogg were conducted at a considerably lower rate, and the electrolytic zinc plant at Silver King was run on a part-time basis. Several of the large mines that had operated regularly for many years, especially those in Shoshone County near Wallace and Morning, were idle during part or all of 1932. In general, the mining industry in Idaho in 1932 was distinctly subnormal and was a continuation of the depressed conditions in 1931.

Several interesting developments, however, augmented the production of both gold and silver in Idaho during the year. Probably that attracting widest attention was the unusually large gold production made by the St. Joseph Lead Co. at its property near Atlanta, Elmore County, as the mines in this region had been virtually idle since 1917. Development at the St. Joseph property—a consolidation of the Atlanta Mines and Boise-Rochester group—had been in progress before the recent interest in reopening old gold mines, but the dredge activity at Warren in Idaho County, the work at the Mayflower mine in Boise County, and much of the activity in Valley County were new features of 1932. The increased output of silver from the Sunshine (Yankee Boy) property was also notable, not only because the production was greatly increased over that in 1931, but because the ore was mined when silver was sold at such an abnormally low price. The mine became the largest producer of silver in the United States in 1932 and produced about 44 percent of the State output of silver.

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1928-32, in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc	Total value
	<i>Short tons</i>		<i>Fine ounces</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	
1928.....	2,054,329	\$433,703	8,998,330	2,072,165	230,645,905	62,526,648	\$26,967,706
1929.....	2,174,125	418,545	9,414,408	5,131,438	237,389,488	61,350,897	31,104,246
1930.....	1,944,800	443,309	9,420,639	3,111,555	208,115,063	75,298,172	21,494,867
1931.....	1,299,927	379,563	7,220,923	1,144,915	198,720,228	39,137,212	11,418,013
1932 ¹	1,031,000	936,434	6,700,000	1,097,000	142,000,000	20,400,000	7,501,161

¹ Subject to revision.

Gold.—The mine output of gold in Idaho remained close to \$400,000 from 1928 to 1931 but advanced to an amount valued at \$936,434 in 1932 due to the greatly increased production from both placer and lode properties. The value of the production in 1932 was the largest since 1916 when \$1,115,810 in gold was produced. The increase in the output of gold in 1932 was due chiefly to the shipment of gold bullion and concentrates resulting from the operation of the mine and mill of the St. Joseph Lead Co. at Atlanta, Elmore County, the increase in the output of gold from the dredge of the Idaho Gold

Dredging Co. near Warren, Idaho County, and the mill of the Yellow Pine Co. near Yellow Pine. Talache Mines, Inc., operating the Gold Hill & Burg, was the largest producer of gold in Idaho, virtually idle in 1932 following the fire of August, however, was reopened and the vein developed. The Idawa Gold Mining Co. and the Boise Gold Corporation, both large producers of gold since 1931, produced gold in 1932.

After spending much time and money in redeveloping the Rochester property and the Atlanta Mines property, building a new 200-ton amalgamation and flotation plant, the St. Joseph Lead Co. became the largest producer of gold in 1932. The new plant had its initial run early in the year. Bullion was shipped to the assay office at Boise. Concentrates were hauled to Mountain Home for smelting. In 1932 the company produced a total State output of gold or more than all other producers produced in 1931.

A comparatively new company which began operations in 1932 was the Yellow Pine Co. at its property near Boise County. The company started operating its plant in January and by the end of the year was the third largest producer of gold in Idaho; the mine produced a quantity of concentrates containing stibnite, the largest quantity of any mine in Idaho. The new dredge of the Idaho Gold Dredging Co. increased its output of gold and ranked second in Idaho in 1932. A new dredge was constructed by the Warren Creek Dredging Co., the old Boise Creek near Pierce was reconditioned by the New Boise Corporation, and the dredge in Owyhee County, the American Gold Dredging Co., was worked by the Superior Leasing Co. The combined output of plants was valued at about \$170,000 compared with \$440,000 by 4 dredges in 1931. Considerable gold was produced by the Golden Anchor Mine near Burdorf, Idaho County, and small mines throughout the State. There was a large increase in the output of siliceous gold ore in 1932 and deposits of gold at the assay office at Boise for 1932.

Silver.—The output of silver decreased 51 percent in 1932, a small quantity compared with the decrease in 1931. Despite the decrease in value from \$2,094,068 in 1931 to \$750,161 in 1932 the State was the second largest producer of silver in the United States, following Utah, as it was in 1930-31.

In the Coeur d'Alene district, which produced 45 percent of the silver output of the State, the Sunshine (Yankee Boy) Mine on Big Lost Creek, most of the remainder was produced from the Hecla, Morning, and Crescent Mines, which produced 45 percent. The Golconda and Page properties in St. Joseph property in Elmore County, and the Bonner County were also large producers of silver. The property increased its silver output about 550 percent, only the largest silver producer in Idaho but but

producer in the United States in 1932. The 500-ton flotation plant was worked regularly and the company paid four quarterly dividends aggregating \$150,000. Large increases in the output of silver were also made from the Crescent on the west side of Big Creek and the Golconda Mines east of Wallace, but unusually large decreases were reported from the Morning, Hecla, Bunker Hill & Sullivan, Hall-Interstate, Page, Blackhawk, Dayrock, and Sherman Mines.

Copper.—The output of copper decreased about 4 percent in 1932, and the value decreased from \$104,187 to \$66,917 as the average price of the metal decreased 3 cents a pound.

About half the copper produced in Idaho in 1932 came from the Sunshine (Yankee Boy) property, as the chief mineral in the ore of this important producer is a variety of tetrahedrite carrying considerable silver as well as copper. It was followed by the Bunker Hill & Sullivan and Hecla properties, where a small quantity of copper is associated with lead ore. The regular copper producers in Idaho, such as the Mackay Metals Co., operating property in Custer County, and the Winder-Stillman Con., operating property in Lemhi County, have been closed since the drop in the price of copper in 1930.

Lead.—The output of lead in 1932 decreased about 28 percent from that in 1931, and the value of the output decreased from \$7,352,981 to about \$3,976,000 as a result of general curtailment of production caused by a continued drop in the average prices of lead and zinc.

Idaho suffered particularly from the extremely low price of lead, as the State produces about 25 percent of the lead produced in the United States. The State, however, maintained its position as the second largest producer of lead in the United States, after Missouri.

The Bunker Hill & Sullivan, Hecla, and Morning Mines were as usual the three largest producers, but the total output of these mines was 26 percent less than that in 1931; the output from the Morning Mine alone decreased more than 20,000,000 pounds, as the property was closed 5 months of the year. Other large producers of lead in 1932 were the Page, Golconda, Sidney, and Whitedelf properties. According to the annual report of the Bunker Hill & Sullivan Mining & Concentrating Co. for 1932 the company mined and treated 429,880 tons of ore compared with 460,366 tons in 1931. The Bunker Hill smelter and refinery were operated on a 1-furnace basis and produced 60,283 tons of lead, 8,528,772 ounces of silver, and 34,760 ounces of gold compared with a production of 77,687 tons of lead, 10,049,526 ounces of silver, and 44,841 ounces of gold in 1931. The sharp decreases indicate a marked reduction in both company and custom materials received at the plant. Dividends paid in 1932 amounted to only \$61,637 compared with \$553,246 in 1931 and \$2,109,690 in 1930. Ore reserves at the end of the year were 2,118,273 tons, and mine development was limited to the new Flood-Pike-Stanley area where important new reserves of ore were opened. The electrolytic zinc plant of the Sullivan Mining Co., which is worked under the control of the Bunker Hill & Sullivan Mining & Concentrating Co., operated continuously during 1932 at about 29 percent of capacity. Although virtually all the important producers of lead in Idaho decreased their output decidedly the Golconda Lead Mines increased its output nearly 1,000,000 pounds.

Zinc.—The zinc recovered from ore and concentrates in 1932 decreased about 47 percent from that in 1931, and the value de-

creased from \$1,487,214 to about \$632,400. Zinc declined from 3.8 cents a pound in 1931 to 2.8 cents in 1932, several of the large producers of lead curtailed production throughout the year, and most of those that continued production. More than 57 percent of the zinc was recovered by roasting and leaching at the Elmer Falls, Mont., and the remainder was recovered by the Sullivan Mining Co. at Silver King, which was operating at one third capacity. The Morning Mine operated at 50 percent production and produced slightly more than 100,000 pounds of zinc for the State, but its output was 56 percent less than in 1931. In order were the Bunker Hill & Sullivan, Star, and Page Mines. The output from all the other mines except the Golconda and Star Mines, was curtailed in 1931.

Mines and mills.—According to the principal report of the Federal Mining & Smelting Co. for the year 1932, the mine in the Hunter district, Shoshone County, was operated 12 days a month from January 1 to May 31, and from June 1 to December 31; the mine was closed from June 1 to May 31. The property is equipped with a 1,200-ton flotation plant. In 1932 the plant treated 102,352 tons of lead ore, 129,267 tons from 1931. The ore contained 1.8 percent silver to the ton, 9.8 percent lead, and 1.2 percent zinc. In 1932 the plant produced 12,194 tons of lead concentrates were produced containing 183,000 ounces of silver and 17,981,158 pounds of lead, and 1,194 tons of zinc concentrates were produced containing 183,000 ounces of silver, 537,361 pounds of lead, and 1,194 tons of zinc. In 1931 a total of 48,146 tons of lead concentrates was produced containing 183,000 ounces of silver, 39,240,023 pounds of lead, and 1,194 tons of zinc. In 1932 the mine was operated at a loss of \$65,170 in 1931 and \$766,091 in 1932. Ore reserves at the end of 1932 were estimated at 3,450 tons of developed ore. During the year the 3,450 level was extended to a total length of 30 feet, making the total length of the level 720 feet on the ore.

The Page and Blackhawk Mines in the Shoshone County, were also operated in 1932 on the same basis as the Morning Mine by the Federal Mining & Smelting Co. According to the printed company report, 19,174 tons of lead ore were produced from the Page Mine and 4,428 tons of similar ore from the Blackhawk Mine. The ore from both mines was treated in the 300-ton flotation mill at the Page property. The Page property produced 4.20 ounces of silver to the ton, 11.1 percent zinc. A total of 3,907 tons of lead concentrates was produced from both mines containing 183,000 ounces of silver, 91,016 ounces of lead, 4,756,646 pounds of gold, and 1,194 tons of zinc. This represents a decided increase in 1931 when 54,909 tons of lead-zinc ore were produced containing 18 ounces of gold, 2,088,834 pounds of lead, and 1,604,781 pounds of zinc.

serves in the Page-Blackhawk group are estimated at 344,400 tons at the end of 1932. Besides properties in Idaho the Federal Mining & Smelting Co. also owns properties in Kansas, Oklahoma, and Missouri, but the only mines worked in 1932 were those in Idaho. The total value of all metals sold in 1932 was \$1,085,844 as compared to \$3,007,304 in 1931. After \$1,510,133 was deducted for cost of production, freight, treatment, and royalty the net operating loss was \$424,289.

The Hercules custom-flotation plant at Wallace was operated part of the year chiefly on ore from the Tamarack & Custer Mine. The total quantity of ore treated in 1932, however, was less than 7 percent of that treated in 1931.

MONTANA

Most of the gold and silver and nearly all the copper produced in Montana depend on the output of copper ore from mines at Butte, Silver Bow County, and the value of the metals recovered from copper material in 1931 accounted for nearly 93 percent of the total value of the metal output of the State. In 1932 the value of gold, silver, copper, lead, and zinc produced from mines in Montana was \$6,667,957 compared with \$19,575,053 in 1931.

The large decrease of nearly \$13,000,000 in the combined value of the metals resulted chiefly from curtailment in the output of copper ore by the Anaconda Copper Mining Co. and the continued drop in the average sales prices of silver, copper, lead, and zinc. The output of each metal except gold decreased to a marked degree from that in 1931—copper 54 percent, lead 73 percent, zinc 67 percent, silver 56 percent, and gold less than 1 percent.

Mine production of gold, silver, copper, lead, and zinc in Montana, 1928-32, in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc	Total value
	<i>Short tons</i>		<i>Fine ounces</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	
1928.....	4,344,279	\$1,203,020	10,853,276	248,262,027	33,759,644	165,650,180	\$55,365,240
1929.....	4,723,445	1,131,949	12,716,977	207,725,973	39,213,707	136,351,734	71,779,547
1930.....	2,686,669	899,091	7,052,889	106,187,523	21,306,044	52,941,108	32,720,418
1931.....	2,085,683	829,102	3,829,837	184,555,735	8,800,180	13,494,986	19,575,053
1932.....	765,000	823,773	1,671,000	84,717,000	2,376,000	4,475,000	6,667,957

¹ Subject to revision.

Gold.—The value of the gold output from both lode and placer mines was close to that of 1931, chiefly on account of the interest in the operation of lode gold mines. A feature in 1932 was the general and continued activity in gold mining which resulted in reopening mines formerly productive as well as prospecting for and developing new ones.

The Jardine Mine at Jardine, Park County, a large producer of gold from 1918 to 1926, was again active in September 1932 and produced more than \$28,000 in gold during the last quarter of the year. Besides gold, part of which is free, the ore contains arsenopyrite and scheelite. The plant includes a 200-ton amalgamation and concentration mill, arsenic plant, and cyanide plant. The I. B. Mining Co. which started working the Sleeping Princess group near Bannack

Beaverhead County, in March 1931 continued throughout 1932. The property is equipped with a crushing plant, and slightly more gold bullion than in 1931. The mine mint at San Francisco. The mine ranked sixth in Montana in 1932. The Liberty Montana property near Jefferson Island, Madison County, worked at one third of its normal capacity. The property produced chalcopryite and pyrite, was treated in a 15-ton concentrator, and copper concentrates rich in gold were shipped for smelting. The production of gold from the property in 1932 was more than double that of 1931. The property became the largest producer of gold in Montana in 1932. It has been a large producer of gold recovered from placer during the last 5 years. The Ohio-Keating property in Broadwater County, was worked by the Ohio-Keating Corporation until September 10 when operations were suspended. 15,000 tons of iron oxide ore were treated in a crushing plant and gold bullion valued at about \$64,000 was shipped. 247 tons of iron sulphide ore containing 1.5 percent of gold to the ton was shipped for smelting. The property's output of gold in 1932 but ranked third in Montana. About 2,800 tons of gold ore from the August Mine near Southern Cross, Deer Lodge County, was shipped from the August Mine near Landusky. The August Mines in the Highlands district 15 miles south of Butte, Silver Bow County received more attention in 1932 than in 1931. The Butte Highlands Mining Co. shipped 1,000 tons of ore containing more than 1 ounce of gold to the smelter. The mine of the Montana Mines Corporation, a subsidiary since 1928, was idle in 1932. The decrease in the output of gold and from the Anaconda group represented a decrease of 14,600 ounces of gold; but the large increase in the output of the Liberty Montana, Ohio-Keating, Jardine, and Butte Highlands properties, and the output from the I. B. Mine and from many small placer mines, parts of the State nearly offset the decrease. The largest gold producers in the State in 1932 were the Liberty Montana, I. B., Ohio-Keating, Anaconda, and the August, and Drumlummon properties.

Silver.—The output of silver in 1932 was less than in 1931 and was the smallest since detailed production was first recorded. The decrease in silver output was due to the curtailment in the output of copper ore from the Anaconda Copper Mining Co., as most of the silver recovered from copper ore mined in Montana is recovered from copper ore mined and shipped for silver, however, much silver-bearing ore is recovered from Kila, Flathead County; Philipsburg, Granite County; and Cascade County.

Copper.—The copper output decreased nearly 54 percent in 1932, and the value of the output decreased to \$2,376,000, the lowest value in the last 30 years. The decrease in the size of the copper output, combined with the average sales price from 9.1 cents a pound

pound in 1932 and the decrease in the value of the silver output, accounted for nearly 95 percent of the total decrease in the value of the metal output of the State.

Despite the large decline in the output of copper the State retained its position as the second largest producer of copper in the United States. In 1932 the Anaconda Copper Mining Co. produced nearly all the State's copper from its mines at Butte, which were kept in operation despite the exceptional drop in the price of copper. The production was less than half that in 1931.

Lead.—The production of lead decreased 73 percent in quantity and 80 percent in value; it was the smallest output since 1903. The decrease of nearly 6,500,000 pounds in the production of lead was due chiefly to the closing of the Jack Waite Mine and mill in March. The property, however, was the largest producer of lead in Montana in 1932, as it was in 1931.

Nearly all the large producers of lead in Montana, especially those at Butte, have been closed since the drop in metal prices. The Block P Mine near Monarch, Judith Basin County, was the largest producer of lead in Montana in 1929 and 1930, but the property was closed during the latter part of 1930 as a result of low metal prices. In 1929 and 1930 considerable lead was also produced from mines near Basin, Jefferson County; Philipsburg, Granite County; Radersburg, Broadwater County; and Melrose, Madison County. The lead smelter at East Helena was operated until June 16 when it was closed for an indefinite period. The receipts in 1932 consisted chiefly of lead concentrates from Idaho and residues from the electrolytic zinc plant at Great Falls.

Zinc.—Nearly all the zinc produced in Montana in 1932 was recovered from treating current slag in the fuming plant of the Anaconda Copper Mining Co. at East Helena. The total output of zinc decreased 67 percent in quantity in 1932 and was the lowest since 1908. The value decreased from \$512,809 in 1931 to \$138,725 in 1932. This large decrease was due to the fact that the production of zinc from current slag at East Helena was suspended when the lead smelter closed in June. The Jack Waite property in Sanders County produced a little zinc, recovered from zinc concentrates shipped to the electrolytic zinc plant at Silver King, Idaho. The electrolytic zinc plant near Great Falls was operated at less than one half capacity, treating chiefly custom material from Utah and Idaho; the electrolytic zinc plant at Anaconda was idle. The custom flotation plants for the treatment of lead-zinc ore at Anaconda and Butte, owned by the Anaconda Copper Mining Co., remained inactive the entire year. In 1929 nearly 74 percent of the zinc produced in Montana was recovered from zinc ore and lead-zinc ore from the mines at Butte, Silver Bow County, but the mines were closed in 1930 as a result of the drop in metal prices. In 1929-30 considerable zinc was also produced from the Block P Mine near Monarch, Judith Basin County, from current slag at East Helena and from mines near Philipsburg, Granite County.

Butte district and Silver Bow County.—The Butte district, by far the most important mining region of Montana, produced 1,869,330 tons of ore and old tailings in 1931 from which \$206,268 in gold, 3,698,676 ounces of silver, and 184,361,564 pounds of copper were recovered or metals valued at \$18,055,786, a decrease from \$29,300,026 in 1930.

The production of gold, silver, and copper from precipitates from the Butte mines in 1932 was \$5,831,736.

The Anaconda Copper Mining Co. was virtually the only producer of copper in the Butte district in 1932. According to the company report for 1932 the mines continued to operate but at a greatly reduced rate. In 1932 the Anaconda produced 97,573,887 pounds of copper, 2,027, and 18,551.5 ounces of gold; nearly all the copper was produced from mines at Butte, but about 83 percent of the gold was from mines outside of Silver Bow County. The Anaconda produced 173,440,855 pounds of copper, 3,640, and 19,486.2 ounces of gold. The electrolytic zinc plant at Anaconda Copper Mining Co. at Great Falls was closed May 6, 1932, and the plant at Anaconda has been closed since 1931. During the time the plant at Great Falls was in operation it produced 33,904,565 pounds of zinc was in concentrates received from mills in Idaho and Montana. Two plants produced 125,983,883 pounds of zinc. The gross sales and earnings of the Anaconda and its subsidiaries in 1932 were \$52,295,611, including all operating expenses, current development charges, repairs, selling and general expenses, to \$57,240,906, resulting in an operating loss of \$5,945,295. With an operating income of \$6,400,427 in 1931 the interest, and expense of carrying nonoperating assets and \$610,063 was allowed for miscellaneous income, the surplus was \$16,893,240. The company paid dividends of \$1,000,000 and the reported surplus at the end of the year was \$16,893,240 compared to a reported surplus of \$69,613,562 in 1930.

No lead or zinc has been produced from the Butte district since 1930 on account of low metal prices. The Noranda, a large producer of copper in 1930, was closed in 1930 and remained nonproductive throughout 1932.

From 1882 to the end of 1932 Silver Bow County, the Butte district, yielded gold, silver, copper, and lead valued at \$2,172,616,484, as follows: Gold, \$37,367,104; silver, \$1,577,522,736; lead, \$21,016,091; and copper, \$1,577,522,736. These values represent 1,807,633.58 ounces of silver, 10,371,575,359 pounds of copper, 10,371,575,359 pounds of lead, and 2,567,395,925 pounds of zinc.

UTAH

The mines of Utah produced gold, silver, copper, and lead valued at \$14,325,782 in 1932, a value less than for 1931 and a decrease of \$14,645,192 from the output of 1931. The production of metals in 1932 was only 15 percent of that in 1931, a year in the history of metal mining in Utah.

The curtailed output of copper ore, chiefly from the property at Bingham, and the decline in metal prices, accounted for 91 percent of the total decrease in the value of the output. There was also a large decrease in the

ore from mines at Bingham and Park City and in lead ore from mines in the Tintic district.

The smelting plants at Murray and Tooele were operated at greatly reduced capacity and for only part of the year, but the lead smelter at Midvale was worked throughout the year on a 1-furnace basis, and the copper plant at Garfield continued to operate at reduced capacity.

Utah remained first in the United States in the production of silver followed by Idaho and Montana, ranked third in copper after Arizona and Montana, and third in lead after Missouri and Idaho.

The fact that the average price of copper dropped to an unprecedented low of 6.3 cents a pound, resulting in the closing of the Utah Copper mine part of the year after the capacity had been greatly reduced, was a severe blow to the mining industry in Utah. Three features of the year, however, were most encouraging for the future of the industry. The Eureka Standard mine continued to be an important producer of gold from ore of smelting grade and surpassed all other mines in Utah in gold production at a time when the Utah Copper Co. was seriously curtailing its output. The high-grade gold ore shipped in 1932 contained the telluride minerals hessite and petzite and gives the mine a unique place mineralogically compared with other active gold mines in Utah. While the Park Utah Consolidated Co. property at Keetley and Park City was virtually idle, the Park City Consolidated Mines Co. resumed operations in March after being idle since June 1, 1931. The company shipped about 21,000 tons of ore containing more than 400,000 ounces of silver, which was sufficient to prevent Utah from losing its lead in silver. The third feature of the year was the continued operation and interesting development in the various properties of the United States Smelting, Refining & Mining Co. at Lark and Bingham.

Mine production of gold, silver, copper, lead, and zinc in Utah, 1928-32, in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc	Total value
	<i>Short tons</i>		<i>Fine ounces</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	
1928	18,427,117	\$4,394,001	17,072,852	203,235,030	291,830,021	93,857,352	\$79,268,004
1929	10,831,075	4,900,015	17,692,394	318,242,523	208,764,420	103,019,485	66,088,701
1930	11,041,841	4,309,148	13,120,421	190,520,423	230,989,780	88,900,938	48,653,464
1931	8,954,017	4,108,323	8,290,900	151,236,505	158,423,453	74,581,072	28,970,971
1932 ¹	3,770,800	2,797,726	6,939,545	65,113,000	123,149,500	59,150,000	14,326,782

¹ Subject to revision.

Gold.—The gold production decreased about 32 percent in 1932, due chiefly to curtailment in output of copper ore from Bingham and to the decrease in the output of gold from mines in the Tintic district. The output of gold from mines in the Bingham district decreased more than 36,000 ounces compared with that of 1931; the output of gold from mines in the Tintic district decreased more than 27,000 ounces; and there was also a decrease in the output of gold from mines in the Park City region. Unusually large decreases in the production of gold were made by the Utah Copper, North Lily, Eureka Standard, Chief Consolidated, and United States Smelting, Refining & Mining companies. A substantial increase in the output of gold was made

at the Yankee Mine in the American Fork district, Utah; the American Smelting & Refining Co. and from mines at Hill, Tooele County.

Although the gold recovered in the past from placer operations has been relatively small, more gold was recovered in 1932 than in the previous years. Most of the gold produced in Utah, however, has been recovered from bullion after smelting copper and lead ore and from furnaces in the Salt Lake Valley or in Tooele County.

An effort was made in 1932 to rejuvenate old lode gold properties in the State, particularly in Park Valley district, Box Elder County; Mercur and Gold Hill, Tooele County; in the Fortuna district, Garfield County; and in the Gold Mountain district, Piute and San Juan Counties.

The largest producers of gold were the Eureka Standard mine in the Tintic district, the Utah Copper, United States Smelting, Refining & Mining Co. properties in the Bingham district; the Yankee (American Smelting & Refining Co.) Mine in the American Fork district; the Delaware property in the Bingham district; and the Mendenhall property in the Tintic district.

Silver.—The production of silver in Utah has decreased in the last 3 years, and the value of the silver output decreased from \$2,404,380 in 1931 to \$1,956,952 in 1932. The average price of silver metal dropped slightly from 29 cents an ounce in 1931 to 28 cents in 1932.

Utah has been the leading silver producer of the United States since 1920. The State retained its position in 1932, although slightly ahead of Idaho. The increased output of silver in 1932 was due almost entirely to the increased output of the King Coalition and Park City Consolidated companies. The output of silver in the Park City region, but the output of silver from the Bingham district decreased more than 900,000 ounces, and the output from the Eureka Standard mine at Park City was the largest producer of silver in Utah in 1932, followed closely by the Tintic Standard mine. The King Coalition mine at Park City was the largest producer of silver in the Tintic district, which held first place in 1931. The large silver producers were the United States, Niagara Falls Consolidated, Eureka Standard, Utah Copper, and Bingham properties.

Copper.—Copper has decreased in Utah from more than 200,000 pounds in 1929 to 65,113,000 pounds in 1932. The output of copper decreased from \$13,762,522 in 1931 to about \$14,326,782 in 1932. The output in 1932 was the smallest since 1928. The average price of copper declined from 9.1 cents a pound in 1931 to 6.3 cents a pound in 1932. The decrease of 57 percent in the output of copper production of the State was due almost entirely to the curtailment in the output of copper ore by the Utah Copper Co. at Bingham. Following the Utah Copper Co., the leading producers were the Silver King Coalition, United States, and Yankee properties.

Lead.—The lead output was valued at \$3,694,485, a decrease from \$3,661,668 in 1931. The output in 1932 was the smallest since 1928. The average sales price of lead declined from 3.7 cents a pound in 1931 to 3 cents a pound in 1932. A substantial increase in the output of lead was reported from the Niagara property, controlled by the

Smelting, Refining & Mining Co. at Bingham, and smaller increases were made at the United States and Lark properties of the same company. Unusually large decreases were reported at the Tintic Standard, Park Utah Consolidated, North Lily, Utah-Apex, Bullion Coalition (Combined Metals Reduction Co.), Chief Consolidated, Plutus, and Utah-Delaware properties. A decrease of nearly 19,000,000 pounds was recorded in the Tintic district, more than 9,400,000 pounds in the Park City region, and more than 4,400,000 pounds in the Bingham district. The largest producers of lead in order of output were the United States, Silver King Coalition, Tintic Standard, Bluestone Lime & Quartzite, and Niagara properties.

Zinc.—The zinc, recovered entirely from milling lead-zinc ore, decreased from \$2,834,081 in 1931 to about \$1,774,500 in 1932. The average sales price of the various grades declined from 3.8 cents a pound in 1931 to 3 cents a pound in 1932, which resulted in a large decrease in the output of lead-zinc ore from mines at Bingham and Park City. The production of zinc in 1932 from the United States mine at Bingham, the largest producer of lead-zinc ore in the State, was much less than that in 1931, and there was also a large decrease in the production of zinc from the Park Utah Consolidated properties near Park City. The Silver King Coalition Mines Co. at Park City, which ranked second as a producer of lead-zinc ore in the State, increased its production of zinc. Most of the zinc concentrate made from ore mined in Utah in 1932 was stock-piled to await a rise in the price of zinc. The largest zinc producers in Utah in 1932 were the United States, Silver King Coalition, and Niagara properties.

Review of districts and operations.—According to estimates made early in 1933 the mines of Utah produced 3,776,800 tons of ore and old tailings in 1932, a decrease from 8,954,617 tons in 1931, chiefly in copper ore. The Bingham district produced about 3,450,000 tons compared with 8,485,873 tons in 1931, and the metal output of the West Mountain or Bingham district was estimated at 70,490 ounces of gold, 1,909,800 ounces of silver, 62,526,000 pounds of copper, 62,720,000 pounds of lead, and 43,740,000 pounds of zinc. The output from Bingham, the most important district of Utah, represented a marked decrease from 106,867.66 ounces of gold, 2,502,057 ounces of silver, 147,706,141 pounds of copper, 67,193,735 pounds of lead, and 53,215,489 pounds of zinc produced in 1931.

According to the printed annual report of the Utah Copper Co. for 1932, the total output for the year dropped to about 42 percent of that in 1931 and was about one third the average annual output for the last 5 years. A total of 3,169,411 dry tons of ore containing 0.976 percent copper was mined and milled. The average recovery of copper in the mill concentrates was 93.15 percent. Mining costs were 45.78 cents a ton and milling costs 59.01 cents a ton. The average cost per pound of net copper was 8.48 cents in 1932 compared with 6.99 cents in 1931. Concentrates shipped to the smelter contained 57,477,385 gross pounds of copper and mine-water precipitates contained 4,484,298 pounds of copper. Metals sold during the year consisted of 55,991,783 pounds of copper, 25,398.63 ounces of gold, and 222,417 ounces of silver which had a sales value of \$3,489,572. The net cost of the metals sold was \$4,595,590 and after miscellaneous income was added and depreciation and metal price adjustment were deducted the net loss for the year to surplus account was \$3,218,887. The company paid no dividends during 1932.

In the annual report of the United States Mining Co. for 1932 the company states that zinc it produced came from the United States mine which was operated continuously during the year. The mine was nonproductive during the year, but activity was carried on at both properties, resulting in an increase in ore reserves.

The mines of the Tintic district produced 4,000 tons of ore and old tailings compared with 216,698 tons in 1931. The estimated production of the district was 50,000 ounces of silver, 980,000 pounds of copper, 18,400,000 pounds of lead, and 115,000 pounds of zinc. The production of gold, 3,286,748 ounces of silver, 1,568,000 pounds of lead, and 791,130 pounds of zinc.

The annual report of the Tintic Standard Mining Co. states that the output from the Tintic Standard mine as compared with 1931 was 8,828 tons of siliceous ore which contained 1,843,612 ounces of silver, 361,561 pounds of copper, and 18,163,057 pounds of lead. The net profit to surplus was \$253,666, and four quarterly dividends of \$230,663 were paid in 1932. The Tintic Standard mine owned 64.45 percent of the issued stock of the Eureka Standard Mining Co. The Eureka Standard mine produced 1,843,612 ounces of silver, 345,083 pounds of copper, and 18,163,057 pounds of lead. The ore had a gross sales value of \$1,843,612. Charges were deducted the net profit for the year was \$253,666. The company paid four quarterly dividends in 1932.

The important output in the section near Park City was from the Mammoth mine, which produced more than 1,000 tons of ore containing gold, silver, copper, and lead, but value of the ore was small. Production from the North Lily mine in 1932 was 832 tons of ore containing 2,872 ounces of silver, and 96,273 pounds of lead. The Chief mine was also small compared with production in 1931. The Grand Central mine, owned by the Chief Consolidated, produced 5,948 tons of smelting ore in 1932 containing 23,348 ounces of silver, and 87,374 pounds of copper. The mill ore and first-class ore produced by the Mammoth mine amounted to about 151,500 tons in 1932 compared with 186,521 tons in 1931. The estimated output of the Mammoth mine was 2,430,000 ounces of silver, 980,000 pounds of copper, 18,400,000 pounds of lead, and 15,300,000 pounds of zinc. The Park City region produced 5,041.06 ounces of silver, 818,545 pounds of copper, 34,740,000 pounds of lead, and 18,871,329 pounds of zinc.

The Silver King Coalition Mines Co. was the largest producer of lead in the Park City region in 1932 and according to the company report 97,496 tons of ore was mined and 19,506 tons of lead concentrates and 13,574 tons of silver concentrates were sold but 10,360 tons of the lead concentrates were placed in storage. The company gave the concentrates and lease ore sold in 1932 a value of \$1,816,671. The output was 1,022,000 ounces of gold, 1,816,671 ounces of silver, 1,022,000

**GOLD, SILVER, COPPER, LEAD, AND ZINC
NEVADA, AND OREGON**

By V. C. HEIKES

CALIFORNIA

The total production of gold, silver, copper and lode mines in California in 1932, in terms of value, was valued at \$12,053,677, a decrease of approximately 10 percent from 1931. Gold was the only metal which showed an increase, representing nearly 98 percent of the total value for 1932. Silver decreased 44 percent in quantity and copper 91 percent compared with 1931, while the recovery of some zinc was reported in 1932. Continued low prices of the base metals were the cause of the reduction in production of silver, copper, and lead, but the decrease in cost of its production resulted in a surplus of labor helped to stimulate the mining industry. The production in 1932 was the largest since 1926. The approximate value of the metals produced in California for the year 1932 was \$12,053,677, the total value of gold, silver, copper, lead, and zinc since 1848 to \$2,144,957,862.

Mine production of gold, silver, copper, lead, and zinc in terms of recovered metals

Year	Gold	Silver	Copper
		<i>Fine ounces</i>	<i>Pounds</i>
1871	\$10,785,315	1,478,771	25,150,743
1872	8,526,703	1,170,895	33,218,994
1873	9,451,162	1,622,803	27,285,272
1874	10,814,162	867,818	12,931,995
1875	11,774,677	456,000	1,136,000

Subject to revision.

Gold.—California again maintained its leadership with its lode and placer mines yielding gold valued at \$11,774,677, an increase of 9 per cent in quantity and \$960,515 in value over 1931. Most of the gold in 1932 was produced from lode mines, such as the Empire-North Star and Idaho, in El Dorado county; the Original Sixteen to One and the Mother Lode in Elmore county; the Argonaut, Central Eureka, and the Yellow Aster in Kern county; and the Yellow Aster in Kern county. Gold from mines on the Mother Lode belt was valued at \$1,000,000, an increase of 10 per cent in quantity and \$100,000 in value over 1931.

Calaveras, Tuolumne, and Mariposa Counties was offset partly by increases in gold from pocket operations in the East belt mines in Tuolumne and Mariposa Counties. Three of the principal mines of the Mother Lode belt produced \$235,266 less gold in 1932 than in 1931, but part of this decrease was offset by the gain of \$110,833 in gold from six important lode mines in Nevada and Sierra Counties. Thirty-two companies, each with an output of more than 1,000 ounces, produced about 83 percent of the total gold yield of the State in 1932. The 10 largest lode and placer gold producers were the Empire Star Mines Co., Ltd. (gold lode); Natomas Co. (6 dredges); Idaho Maryland Mines Co. (gold lode); Yuba Consolidated Gold Fields in Yuba County (3 dredges); Capital Dredging Co. (3 dredges); Argonaut Mining Co. (gold lode); The Mountain Copper Co., Ltd. (gold lode); Original Sixteen to One Mine, Inc. (gold lode); Kennedy Mining & Milling Co. (gold lode); and the Merced unit of the Yuba Consolidated Gold Fields (1 dredge). Much gold has been recovered in the past from copper ores mined in the State, but in 1932 the output from this source was small.

As the gold-dredging fields of the State become exhausted the production of gold from lode mining is steadily exceeding that from the placers. According to a report of the California Debris Commission for 1932, issued by the War Department, 44 hydraulic placer mines were granted permission to operate, and 1,062 applications for licenses were pending. Surveys have been made in the area under the jurisdiction of the commission of those portions of the Yuba, Feather, Bear, and American Rivers containing great deposits of mining debris. Hydraulic mining is opposed by the agricultural interests in the valley counties, and in some parts of northern California placer mining is restricted 3 months of the year. Since the beginning of dredging in the Oroville district \$174,526,417 in gold has been produced, and of this output the Feather River field is credited with \$33,621,406, the Yuba River field with \$67,049,597, and the American River field with \$44,793,178. Various estimates of the future life of the remaining dredging ground have been made, but no definite figures are available. Yuba County, formerly one of the largest gold-dredging areas in the State, is now supplanted by Sacramento County, where the dredge gold output from the Folsom field has increased the last 2 years. Twenty-two dredges in Amador, Butte, Calaveras, Merced, Sacramento, Shasta, Stanislaus, Trinity, and Yuba Counties produced 188,730 ounces of gold, valued at \$3,901,395, from 48,851,063 cubic yards of gravel, with an average recovery of 8 cents a cubic yard in gold. In 1931 the dredge gold production was \$3,619,355 from 22 boats handling 44,423,652 cubic yards of gravel. Another dredge was added to the Folsom field by the Gold Hill Dredging Co., which moved its 9-cubic-foot dredge from Dayton, Nev., for operation on the American River. The Cal-O-Dredging Co. completed its boat, which began digging early in 1933, on gravel south of Yreka, Siskiyou County. The gold obtained from drift placers in California is nominal, and the largest output from this method of mining in 1932 was from Calaveras County. The Calaveras Central drift mine near Angels Camp was an important producer, and late in 1932 the Tonopah Belmont Mining Co. took control of the Vallecito-Western drift mine near Angels Camp, a producer of gold for several years. Production was continued by the new company.

Small-scale gold mining.—Increasing interest in small-scale gold mining lured many people to the foothill counties and other gold regions in northern and southern California. Many prospectors recovered enough precious metal to pay their living expenses. An experienced prospector also joined in exploring quartz veins and reopening old prospects and old prospects. The results of the gold rush of 1932, in which thousands of prospectors terminated in some places in about 90 days. High water or snow restricted work and hampered prospecting in certain regions, while in a few places the work continued all the year.

The records of those who bought gold from the State, miner, and layman in compliance with the California law, administered by the State mineralogist, were compiled with the following results, which are of interest in connection with small-scale gold mining.

Ninety-four bullion dealers in California, including merchants, and private refiners, all licensed by the State of California to purchase gold in 1932, sold to the State and other refiners 23,870 fine ounces or \$493,437 of gold. This total compares with \$162,000 in gold purchased by the State in 1931. The reports of the bullion buyers in 1932 showed that individuals produced 30,880 lots of new gold coin, nuggets, and amalgam with a range in value from \$100. The average value of each lot sold was \$16.12. The amount received by the prospectors for their labor in 1932 was \$41.12.

The licensed bullion buyers located in 17 counties were working in all known mineral areas of California. The gold and that of established mines was deposited with the State Mint, which issued 19,265 deposit certificates, compared with 8,153 settlement certificates in 1931. The gold deposited was from California, with important lots from the Philippine Islands, and Arizona. Other States included Nevada, Oregon, New Mexico, Montana, Utah, and Idaho. The minimum amount of gold received at the State Mint was 2 ounces, equivalent to about \$40. The gold was returned to the sender whose only receipt was a bullion dealer's receipt.

The nearest bullion dealer in California paid full value for the gold. Prospectors have discovered the saving in charges on each lot sold and the added advantage of cash or merchandise.

Amador County bullion buyers at Plymouth sold 1,885 fine ounces of gold valued at \$6,519 for 58 lots. The average deposit was \$9.73 or \$11.24 for the season. The gold originated from the Consumnes River in Eldorado and Yuba Counties. Gold was also reported from Sutter, Yuba, and Scott Creeks, and a little gold was recovered from the Feather River.

In Butte County 6 bullion buyers bought 2,740 fine ounces of gold valued at \$57,060 from 2,052 individuals, at an average of \$12.83 per deposit, or \$27.81 for the season. The gold recovered chiefly from placer gravel of the Feather River in Butte and Plumas Counties and in more than 50

Calaveras County bullion buyers at Angels Camp, Mountain Ranch, and Camanche handled 484.62 fine ounces or \$10,018 in gold. There were 488 individuals who sold 610 lots of gold dust averaging \$16.32 a deposit, or \$20.53 for the season. Most of the gold was from the Mokelumne River in Amador and Calaveras Counties. Particular localities mentioned in the reports received from buyers were Rich, Hicks, Wet, and Adobe Gulches and the O'Neil, McKinney, Murray, Jesus Maria, Martins, and Chile Creeks.

Del Norte County gold producers sold most of the gold recovered from beach sands to private refiners of platinum metals. The gold produced in the interior districts was shipped to banks at Grants Pass, Oreg., and to the San Francisco Mint. The burlap table continued to be the popular method for recovering gold from beach sands in Del Norte County.

Eldorado County bullion dealers at Volcanoville, Placerville, Pilot Hill, and Georgetown purchased 648.76 fine ounces or \$13,411 in gold, representing 1,059 lots of gold dust from 654 individuals. The average of each lot was \$12.66, and \$20.51 was the average result of a season's work for each person. Most of the gold was produced from the vicinity of Placerville, Webber Creek, and Big Canyon Creek.

In Fresno and Madera Counties bullion dealers at Fresno, Friant, Orange Cove, Selma, and Coarsegold purchased 414.67 fine ounces or \$8,572 in gold, representing 833 lots from 634 individuals. The average lot amounted to \$10.29, and the result of the season's work amounted to \$13.52 for each individual. Most of the gold was from the abandoned gravel pits near Friant. Many white families and a few Indians were camped near the gravel pits and along the San Joaquin River during the year and made a scanty living from their labors. In the vicinity of Coarsegold most of the gold was from Deadwood, Cabin, Coarsegold Gulch, and the Fresno River.

Humboldt County prospectors sold small lots of gold to a bank at Eureka and shipped bullion direct to the San Francisco Mint. Gold was produced from the beach sands at Gold Bluff and from the bench gravel on the Klamath and Salmon Rivers, most of it originating near Orleans, and sold to a buyer at that point.

Kern and San Bernardino County dealers in gold dust at Cantil, Bakersfield, and Hobo Hot Springs and various Los Angeles refiners of gold bullion handled gold produced by about 200 individuals, whose total output for the season could not be learned, but judging from gold sold at Cantil the average for the season was about \$20. Most of the gold came from the vicinity of Randsburg, Goler, Oro Fino, Summit Diggings, Black Mountain, and Boulder Gulch. Other localities in San Bernardino and Kern Counties mentioned frequently were Atolia, Panamint, Lytle Creek, and the Goldstone district.

Mariposa County bullion dealers at Mariposa, Bagby, Hornitos, Coulterville handled 265 small lots of gold for 209 individuals, whose combined output amounted to 160.84 fine ounces, or \$3,325 in gold. An average of \$12.55 in gold was sold, and the prospector received \$15.91 for the season. Most of the gold was from Saxon, Agua Fria, Mariposa, Chispia, Sherlock, and Solomon Creeks; Australian Gulch and Merced River also furnished some gold.

In Nevada County 8 bullion buyers at Nevada City, French Corral, North San Juan, and Bridgeport purchased 3,636.72 fine ounces of gold valued at \$75,178 from 1,346 individuals whose gold

lots averaged \$27.00 a lot, or \$55.85 for the season. The gold was reported from placers on Deer Creek and came from small lots of crushed quartz originating in the Grass Valley region.

Placer County bullion buyers at Auburn, Colfax, Foresthill, Gold Run, and Sheridan purchased 1,293 lots of gold dust averaged \$15.08 a lot, or \$36.41 for the season. Most of the gold was from the North, South, American River and Buckeye, Blue Canyon. The localities frequently mentioned were Stead, Baltimore, Shirt Tail Canyon, Georgia Hill, and Plumas County.

Plumas County bullion buyers representing at Quincy, La Porte, Belden, Virgilia, Kedes, purchased 1,800.04 fine ounces of gold valued at \$12.60 for each lot of gold sold. Most of the gold was from Spanish, Nelson, Squirrel, Rush, Black Hawk, Feather River and streams and tributaries in the vicinity of La Porte.

In Sacramento County three bullion dealers purchased 553.41 fine ounces of gold, chiefly from the Placer, and Eldorado Counties. A total of 6 lots of gold were sold, averaging \$16.92 for each lot sold and \$16.92 for the season.

Siskiyou County was the most favorable of the small prospector who averaged \$57. From records of 10 bullion buyers Camp, Sawyers Bar, Forks of Salmon, and individuals sold 4,308.49 fine ounces of gold or \$8 per lot. The placers of the Salmon River and the North Central region were most frequent seekers.

Shasta County prospectors sold most of the gold in Redding, which handled some gold in other counties. Altogether, 3,271 small lots of gold were sold, retorted material ranging from 9 cents to about 1,258 individuals, whose average gold sold was about \$12.55. The gold was from French Gulch, Whiskeyto, Clear Creek, Squaw Creek, Beegum, Cottonwood Creek, and the Sacramento River.

In Trinity County producers of gold sold 1,609 lots of gold averaged \$12.55 for the season. Most of the gold was from the Trinity River and its tributaries.

In Tuolumne County 1,046 individuals sold 1,152.15 fine ounces of gold valued at \$23,817, or an average of \$22.77 for the season. The gold was recovered from placers, but some came from the East Belt region and on the Mother Lode. It was reported from various creeks (Turnback, Mormon, and Eagle) and from the Stanislaus and

The deepest producing properties in California are the Argonaut and Kennedy mines in Amador County, each with workings at a vertical depth of over 5,000 feet. Nevada County mines, chiefly in the Grass Valley-Nevada City region, are developed to a vertical depth of over 4,000 feet; some of the richest ore is mined in the upper levels at a depth of about 2,000 feet. The five leading mines produced more gold in the last 2 years than any district in California. In 1932 the output was \$3,395,000 in gold compared with \$3,191,820 in 1931.

The Empire Star Mines Co., Ltd., at the end of the year had put the Murchie mine on a profit-earning basis after an expenditure of about \$500,000. The flotation mill and mine equipment were materially improved; the shaft was also reconditioned and sunk an additional 300 feet. Operating costs were lower for the Murchie than for any mine in the Grass Valley-Nevada City district. According to the annual report of the Empire Star Mines Co., Ltd., for the calendar year 1932, the North Star and Pennsylvania properties were practically without pay ore by midsummer, but by making a 10 percent cut in all wages and salaries paid by the company and with the reduced cost of powder all mines continued in operation although the North Star mine remained unprofitable. During 1932 underground development totaled 22,757 feet and diamond drilling 1,787 feet. The company mined 207,322 tons of ore, including lease ore, compared with 267,500 tons in 1931. The mills reduced 228,156 tons of ore with a 95.96 percent extraction compared with 214,534 tons milled and an extraction of 95.90 percent in 1931. The average gold recovery per ton of ore was \$8.789 compared with \$9.435 in 1931 and \$9.442 in 1930. This drop in mill heads was slightly compensated by a further drop in total costs to \$6.92 a ton compared with \$7.08 in 1931.

The Idaho Maryland mine according to the annual report of its holding company, the Idaho Maryland Consolidated Mines, Inc., produced 58,245 tons of ore in 1932. Of this quantity 36,805 tons were treated in the Brunswick flotation plant and 21,440 tons in the Idaho Maryland amalgamation-flotation mill. The total gold and silver recovered from ore milled amounted to \$979,420, an average of \$16.82 a ton compared with \$13.84 in 1931. The average loss in the tailings at both plants was \$1.14 a ton compared with \$2.13 in 1931. With bullion and smelter charges deducted the net value of the year's output was \$954,712. Total expenditures amounted to \$485,936.94, including compensation insurance, local and State taxes, mine development, metallurgical experiments, and alterations but without interest or smelter charges. The total cost was \$8.34 a ton of ore milled.

The Hoge Development Co. continued development work in 1932 by adding 1,000 feet of drifts and 1,500 feet of raises to its property. About 6,000 tons of ore were treated at the Murchie mill of the Empire Star Mines Co., Ltd., and a similar quantity was treated at the Hoge flotation plant after its completion in September. The property of the Golden Center Mines Co. is opened by a 1,300-foot inclined shaft and 10,472 feet of drifts. The gold associated with sulphide minerals carrying silver, copper, and lead was recovered in a 20-stamp amalgamation gravity concentration mill until September when flotation cells replaced table concentration. Gold bullion was shipped to the San Francisco Mint and lead concentrate to the Selby smelter and to a metallurgical plant in South San Francisco.

NEVADA

The value of the mine production of gold and zinc in Nevada, in terms of recovered metal, was \$11,673,787 in 1931 to about \$5,135,792 in 1932. In the 1931 production there were decreases in all metals, substantial ones being recorded in copper, lead, and zinc. Silver decreased 40 percent and value compared with 1931.

Mine production of gold, silver, copper, lead, and zinc, in terms of recovered metal

Year	Gold	Silver	Copper
		<i>Fine ounces</i>	<i>Pounds</i>
1928.....	\$3,620,833	5,481,674	168,876.8
1929.....	3,384,211	4,923,626	140,138.8
1930.....	3,081,436	4,219,832	109,203.5
1931.....	2,941,473	2,562,071	72,634.4
1932 ¹	2,005,607	1,390,100	31,473.0

¹ Subject to revision.

Gold.—The gold from mines in Nevada in 1931 to about \$2,695,607 in 1932. The production in 1932 recalls the period from 1892 to 1895 when the output was below \$2,000,000 a year, reaching the lowest point in 1895. Mine production was \$985,700. Gold discoveries at Delamar, which again an important gold-producing district. Gold accounted for 52 percent of the total gross value of metals produced. Five companies, each producing between 10 and 20 percent of the total, yielded 52 percent of the State total; the other five, with 6 other companies, each producing less than 10 percent, yielded over 71 percent of the total. Due to the decrease in mining activity in 1932, the yield of gold did not increase as it did in 1931. In the Robinson district, White Pine, considerable gold has been recovered heretofore, but in 1932, a substantial decrease was recorded; but in Esmeralda County, the output of gold exceeded that of 1931. The leading gold-producing mines of the Tonopah district produced a total of \$1,100,000 in 1932. The leading gold-producing mines in 1932 were the Elko Mines Co. at Jarvis, the Nevada Consolidated Co. at Goldfield; the Nevada Consolidated Co. at Gold Hill Development Co. and the Nevada Consolidated Co. at Round Mountain.

A record of the exact number of people employed in placer gold during 1932 is not available, but the State Bureau of Mines estimate that 600 to 700 men were employed in placer areas. The gold produced in recent years has increased over that of the previous years. The gold produced by small-scale mines was not so much as in 1931. Placer areas producing in 1932, named in order of production, were Round Mountain, Battle Mountain, Manly,

Silver.—The silver production from mines in Nevada decreased from 2,562,071 fine ounces in 1931 to about 1,390,100 ounces in 1932 and the value from \$743,001 to about \$392,008. The Tonopah district produced about 591,300 ounces, a decrease of 232,572 ounces compared with 1931. Lessees continued to work in the properties of the Tonopah Mining, Tonopah Belmont, and Tonopah Extension mines and cleaned up ore and material in the mines and milling plants of these companies. The Desert cyanidation custom plant of the Tonopah Mining Co. at Millers closed in May after 25 years of operation, and dismantling of the mill was well under way in October. Other important silver producers were the Nevada Consolidated Copper Co. at Ely, the Gold Hill Development Co. at Round Mountain, and the Ely Revenue at Ely.

Any revival in the price of silver will benefit mining as it is a by-product in almost all of the copper, lead, and zinc ores mined in Nevada.

The ores of the Tonopah, Tybo, Pioche, Cortez, Comstock, Rochester, Eureka, and 60 or more other districts past producers of silver promise much activity, but at present no large-scale silver mines are operating. The principal mines in many districts are ready to resume operations whenever it becomes possible to do so, but the continued low prices of silver and the possible disruption of railroad service may cause a long shut-down. The mines are fully equipped with modern operating facilities including reduction plants.

Copper.—In 1932 the mine production of copper in Nevada was 31,473,600 pounds, a decrease of 41,160,897 pounds or 57 percent from 1931. The total value decreased 70 percent or \$4,626,902. Concentrates yielded most of the copper in 1932, as the low price of the metal cut down shipments of crude ore. Most of the copper was produced in the Robinson district, White Pine County, by the Nevada Consolidated Copper Co. and the Consolidated Coppermines Corporation, both companies suffering heavy losses. The operations of both mines and reduction works were on a part-time basis. Some blister copper was shipped to Italy during the year.

Lead and zinc.—The lead output from mines in Nevada decreased from 15,860,634 pounds in 1931 to about 1,195,200 pounds in 1932, and the value decreased from \$586,843 to about \$35,856. The largest producer was the Combined Metals Reduction Co., in Lincoln County. Zinc-lead ore was shipped from the Yellow Pine district in Clark County to eastern oxide plants. Nevada's zinc output in 1932 was estimated at 982,800 pounds valued at \$29,484 compared with 20,861,348 pounds valued at \$792,731 in 1931.

Review of mines and mills.—Production in Churchill County in 1932 was confined to a mill clean-up and to small lots of gold ore mined in the Fireball district and treated by amalgamation at Olinghouse. Gold-silver ore was shipped to a smelter from the Fairview district.

In Clark County the Crescent, Eldorado Canyon, and Searchlight districts produced gold chiefly from the Eldorado-Rand, Quartette, and Duplex mines. Oxidized zinc-lead ore from the Yellow Pine district, aggregating 600 tons, was reduced at the Ozark works in Kansas. The ore was principally from the Yellow Pine, Bullion, and Anchor mines. A new discovery of gold was made in the Chiquita claim adjoining the Keystone, a former gold-producing mine, and gold bullion was shipped to the San Francisco Mint.

The production of molybdate of lead attracted attention to the Shenandoah project. Some molybdate of lead was forwarded to the foreign market, and arrangements were made with the Kingman, Ariz., for future treatment.

Elko County mines produced gold, silver, and copper. Jarbidge and Gold Circle were the two large producers of gold.

The Elkoro Mines Co. at Jarbidge, according to its holding company for 1932, had exhausted its property in September. The mine and 100 acres have produced about 20,000 ounces of gold. In 1932, the company treated 40,517 tons of ore at a profit of \$138,878.

At Midas in the Gold Circle district lessees of Buena Gold Mines Co. made important shipments of bullion recovered by amalgamation and cyanidation. Ore was also shipped to smelters in Utah.

The outstanding development in Elko County was a large deposit of copper ore in the Rio Tinto district. The first car of ore shipped to a smelter was 47 percent of copper, a little silver, and a trace of gold.

Esmeralda County produced chiefly gold at Goldfield, Gold Mountain, Silver Peak, and other parts of the Tonopah district. The minerals mentioned under Nye County.

Goldfield district production in 1932 was confined to the Consolidated mine and the property of the Goldfield Mining Co., each worked by lessees who shipped ore to the Goldfield Mining Co., Inc., continued to treat the old Goldfield mine and handled 281,000 tons of tailing dump. Output amounted to \$360,951 in gold, 9,257 ounces of copper.

At Silver Peak various leasing interests of the Mammoth companies and the Calumet Gold Mines Co. produced about 1,800 tons of ore from the Mary mine in the Black Mammoth and Liberty Division. The mine has flotation mills and the old Mary mine has a cyanidation plant. The total output of the mine was approximately \$91,000 in gold, and some silver ore, bullion, and concentrate.

Production in Eureka County was confined to the district, from which lessees shipped lead ore to the Eureka property and the Bear, Cyanide, and other groups to Utah smelters. The Buckhorn mine produced and shipped gold and silver ore to the district about 50 men worked placers, and one found good pay gravel after removing considerable material.

In Humboldt County the production consisted of gold from Buckskin mine in the National district and silver from Ten Mile, Daveytown, and Paradise.

Lander County mines were important producers of copper until 2 years ago. Now copper ore is held in reserve for better prices, and gold ore discovered by lessees of the Copper Canyon Mining Co. near Battle Mountain has been worked since 1931. The output of over \$100,000 in gold from the lode and placer properties in the county was greatly in excess of that in 1931.

At Round Mountain, lode mines and placer silver valued at \$518,386 in 1932 compared with \$203,159 in 1930. The Gold Hill Development Co. annual report for 1932, opened up its property to a depth of 3,503 feet, part of which was on the deepest level. Progress in sinking or crosscutting to the Gold Hill mine to a halt at a depth of 645 feet owing to an exhausted ore body. All available commercial ore, except portions of the Gold Hill mine, practically exhausted at the end of the year. The company requiring additional pumping facilities the discontinuance of operations in the mine and the output of the Gold Hill mine for 1932 was 38,055 tons. The output of the Gold Hill mine was milled in the company cyanidation plant. The output of gold and 1.91 ounces of silver, valued at \$1.00 per ounce. The recovered bullion contained 11,755.02 ounces of silver, representing 91.59 percent of the silver. The average cost of mining and that of mining \$3.94 a ton, which includes a ton and a development cost of \$0.787 a ton.

During repairs to its Sunnyside stamp-
Nevada Porphyry Gold Mines, Inc., at Round
operations, but its placers were worked con-
placer mining was piped 9 miles from the Toy
was recovered by amalgamation from ore of t
the owner of which operated a small tube m
development work was done in the mine.

In Pershing County most of the mine production has come from the Seven Troughs and adjoining districts. The large cyanidation plant remained closed. Production was reported from small dry-washing operations in the Seven Troughs and near Imlay. Placer ground also was worked in the Seven Troughs districts but with indifferent success.

In Washoe County the White Horse district produced gold from the operations of many various properties of the district, chiefly the ore was treated in the Springfield amalgamation.

In White Pine County the value and quantity of metals was substantially less than in 1905, but it exceeded that of any other county in Nevada.

Nye County produced more gold in 1932 than any other county in Nevada. Gold amounted to about \$728,000 and silver to about

individuals representing prospectors and small working parties who averaged \$126.32 in gold during the year or season, chiefly from placer ground in Josephine and Jackson Counties. Most of the gold was reported from Evans, Footh, and Sterling Creeks in Jackson County and Grave and Althouse Creeks in Josephine County. Gold producers in Coos, Curry, Douglas, and Linn Counties also sold gold in Grants Pass.

Next to dredging, hydraulic gravel mining had special interest. The Flynn placer mine on the Illinois River, 3 miles from Takilma, the Plataurica hydraulic property in Fry Gulch, and the Llano de Oro hydraulic placer near Waldo were all producers. In the Althouse Creek region many small-scale producers of gold added to the regular output of the Ramsey claims, 12 miles from Holland. The Tigertown hydraulic mine was worked on a small scale, and the John Apple hydraulic mine, 7 miles south of Holland, produced gold. Placers on Sucker Creek were active; the Barnett was hydraulicked to full capacity. Small-scale placer mining progressed on California Bar, and some gold was sold to the local storekeepers. Hydraulic placers were worked on Jump-Off Joe Creek and tributaries. The chief gold producers were the Weymouth and placers on Jack's, Briggs, Hogum, Starveout, and Silver Creeks. A power shovel and trucks to transport gravel to a washing plant were placed on Louse Creek at the Lindar gravel property. Sardine Creek had the largest mechanical placer outfit in southern Oregon, a 1½-yard power shovel handling 100 yards of gravel hourly. On the banks of the Rogue River in Josephine and Jackson Counties small groups were at work. Drift placers were worked in 12 places within the city limits of Jacksonville, by shafts 12 feet in gravel to bedrock, and very few large wash boulders were encountered. Some beach mining was carried on in Coos and Curry Counties, and the Mule Mountain district in Curry County was actively prospected.

Lode mining was productive in few instances in southwestern Oregon, but plans for financing several mines were under way. A Straub mill was installed on the Brady mine at Whiskey Creek, and the Mead property on Jones Creek was opened with a crosscut drift. A new mill was ready to operate in December on ore from the Towne mine at Jacksonville, and the Opp mine enlarged its reserve of milling ore. A 20-ton mill was constructed at the Sunbeam mine, 15 miles south of Grants Pass. At the head of Louse Creek gold ore averaging \$75 a ton was developed in the Granite Hill mine. The Humdinger mine, actively developed in 1931, was turned back to the owner, and no production was reported for 1932. In Jackson County the Ashland mine was developed, and some bullion was sold to the San Francisco Mint. Bullion was shipped from the American Boy mine southwest of Medford. The Chieftain and Continental lode mines in Douglas County and the quartz property of the Bartels Mining Co. in Lane County were producers of gold. Considerable development work was done at the Continental, and at the Chieftain the 15-ton floatation mill was operated. In Marion County the Amalgamated Mining Corporation operated a mill and shipped lead-zinc concentrate to Midvale, Utah.

GOLD, SILVER, COPPER, LEAD, AND ZINC NEW MEXICO, TEXAS, SOUTH DAKOTA

By CHAS. W. HENDERSON

COLORADO

In 1932 the output of gold, silver, copper, lead, and zinc from Colorado ores and gravels, in terms of recovered metal, was 314,117 ounces of gold, 1,703,378 ounces of silver, 4,116,800 pounds of copper, 4,116,800 pounds of lead, and 492,536 ounces of zinc. Compared with 1931 gold increased \$1,492,536 ounces, copper decreased 1,000,000 ounces, silver decreased 9,651,200 pounds, and zinc decreased 322,000 pounds. The approximate gross value of the output of metals was as follows: Gold \$6,493,377, silver \$48,222,734, copper \$123,504, and zinc \$6,540, a total of \$77,942,154 in 1931.

Mine production of gold, silver, copper, lead, and zinc in terms of recovered metals

Year	Gold (lode and placer)	Silver (lode and placer)	
		Fine ounces	
1928	\$5,304,876	4,052,253	
1929	4,417,358	4,307,377	
1930	4,617,610	4,382,852	
1931	4,822,734	2,195,914	
1932	6,493,377	1,703,378	

Year	Lead	
	Pounds	Value
1928	53,501,723	\$3,103,100
1929	48,889,906	3,080,064
1930	44,280,000	2,213,000
1931	13,768,000	509,416
1932	4,116,800	123,504

¹ Subject to revision.

The value of metal production herein reported is in terms of the average New York price for bar gold, silver, copper, lead, and zinc at the figures given in the table that follows. The price of gold is the average New York price for bar gold; that is, \$20.67183 per ounce. The price of silver is the average New York price for bar silver; that is, \$1.29 per ounce. The price of copper is the average New York price for primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1928-32

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	<i>Per fine ounce</i>	<i>Per pound</i>	<i>Per pound</i>	<i>Per pound</i>		<i>Per fine ounce</i>	<i>Per pound</i>	<i>Per pound</i>	<i>Per pound</i>
1928.....	\$0.685	\$0.144	\$0.058	\$0.061	1931.....	\$0.290	\$0.091	\$0.037	\$0.038
1929.....	.533	.176	.063	.060	1932.....	.282	.063	.030	.030
1930.....	.386	.130	.050	.048					

Review by counties and districts.—The Cripple Creek district in 1932 produced \$2,260,507 in gold compared with \$2,385,769 in 1931. The Golden Cycle 1,200-ton roast-amalgamation-cyanidation custom mill at Colorado Springs was operated at the rate of 800 to 900 tons daily, principally on Cripple Creek sulphotelluride ores. All Cripple Creek ores are treated at this mill. During 1932 part of the 300-ton selective flotation mill added to the Golden Cycle equipment in November 1929 was used intermittently to treat custom gold-silver ores from Boulder, Clear Creek, Gilpin, Lake, and Park Counties, chiefly gold (silver-lead) ores from Park County from September 10 to the end of the year; the tails from the flotation machines went direct into the cyanide circuit or to the roasters to burn the carbon in the American ore. Producing mines and dumps in the Cripple Creek district included the Acacia, Atlas, Buckeye, Cresson, Doctor-Jack Pot, El Paso, Elkton, Empire Lee, Gold Dollar, Gold Pinnacle, Granite, Jerry Johnson, Pharmacist, Portland, School Section, Stratton Estate, Strong, and United Gold Mines. The Cripple Creek district has yielded \$354,022,394 in gold from its discovery in 1891 to 1932, inclusive.

San Juan County in 1932 produced \$511,092 in gold, 339,965 ounces of silver, 1,031,000 pounds of lead, and 1,367,000 pounds of copper compared with \$647,208 in gold, 430,793 ounces of silver, 1,250,505 pounds of copper, and 1,134,000 pounds of lead in 1931. The Sunnyside Mining & Milling Co. 1,000-ton selective flotation mill at Eureka continued idle. The 550-ton Shenandoah-Dives selective flotation mill operated throughout the year on gold-copper-silver-lead ore from the Mayflower group.

The Durango lead bullion-copper matte smelter which closed November 1, 1930, remained idle.

No ores were marketed from Rico, Dolores County, but the St. Louis Smelting & Refining Co. completed its 6,000-foot adit.

In San Miguel County a small production was made from the mines at Ophir, and lessees continued gouging operations in the Smuggler-Union mine at Telluride, sold in 1929 for its salvage value. Clean-ups were made at abandoned mills in the Telluride district. The Cimarron mine at Telluride was reopened.

The King Lease on the upper workings of the Camp Bird mine, Ouray County, continued to extract gold ore which was treated in the amalgamation-concentration mill built by the leasing company at the upper adit, in Imogene Basin. Production of small lots of high-grade gold-silver ore from the Trust-Ruby property at Sneffels was continued. Other small producers in Ouray County were the American, Banner American, Governor, and Valley View.

GOLD, ETC., IN COLO., N.MEX., TEX.,

Gold, silver, copper, lead, and zinc mined in Colorado in 1932, by counties, in terms of recovered metals

County	Gold † (node and placer)		Silver ‡ (node and placer)		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Adams.....	10.02	\$307									\$207
Archuleta.....	1.56	32									32
Boulder.....	4,174.23	96,289	11,737	\$3,310	15,000	\$450	15,000	\$450			90,049
Charles.....	3.28	68	745	210	6,000	180	6,000	180			3,818
Clear Creek.....	5,798.96	119,876	26.153	7,375	72,000	2,160	72,000	2,160			129,789
Costilla.....	7.63	158									158
Custer.....	1.18	24									27
Denver.....	18.64	385	11	3							385
Dolores.....	4.60	96	4	1							96
Douglas.....	32.38	669	2	1							671
Essex.....	2,970.75	61,411	1,110,819	313,251	5,620,000	354,060	440,000	13,200			741,572
Elbert.....	27.58	579			1,000	63	5,000	150			570
Fremont.....	42.42	877	568	160	51,000	3,213	187,000	5,610	84,000	\$2,520	1,250
Grand.....	15,637.32	323,252	24,451	6,895	51,000	3,213	187,000	5,610			341,490
Harrison.....	1.77	37									37
Hinsdale.....	154.88	3,202	67	19							3,221
Huerfano.....	69.19	1,430	871	246	1,800	54					1,730
Jackson.....	1.81	37									37
Jefferson.....	5.64	117									117
Lake.....	9.04	187									187
La Plata.....	6,235.47	129,312	18,768	4,729	6,000	378	152,000	4,560	126,000	3,780	142,759
Larimer.....	1,467.89	30,344	6,966	1,964							32,518
Lincoln.....	84	17									17

Small but slightly increased shipments of gold ore were made from the May Day and other mines at Hesperus, La Plata County. The La Plata Mines Co. continued development work at the Gold King mine above La Plata and operated its mill intermittently.

Eagle County continued in 1932 as one of the principal producing counties in Colorado through the production of the Empire Zinc Co. Eagle mine from ore bodies in the Leadville limestone formation, dipping northeastward under Battle Mountain near Redcliff. Since 1912 this company has been opening and developing its holdings, always with some regular annual production; from November 1929 to December 1, 1931, the company ran its new 600-ton flotation mill on zinc-lead-silver-iron sulphide ore. This mill is built in an excavation cut into the granite face of Eagle Canyon and therefore is mostly underground. In 1931, in addition to milling zinc-lead ore from its large reserves, the company continued to ship copper-iron-silver-gold ore to Utah smelters. In 1932 this smelting ore was shipped both to Utah smelters and to the Arkansas Valley smelter at Leadville, which was equipped to handle copper ores. Several cars of gold ore were shipped to Leadville from the reopened Champion mine on Battle Mountain, many years ago a prominent gold producer from ore bodies in the Cambrian quartzite formation.

Lake County (Leadville) in 1932 produced 6,255 ounces of gold, 16,768 ounces of silver, 152,000 pounds of lead, 6,000 pounds of copper, and 126,000 pounds of zinc compared with 5,055 ounces of gold, 81,183 ounces of silver, 33,308 pounds of copper, 2,940,514 pounds of lead, and 5,773,000 pounds of zinc in 1931. The Leadville district produced no iron-manganese ore in 1932. The Leadville Deep Mines Co. properties remained idle. Gold ore was shipped from the Ibex, Tribune, and Venir mines. Development was continued at the Resurrection group. The Arkansas Valley smelter was idle during January and October. It ran as a lead-bullion smelter in February and March, as a copper-matte smelter from April through August, and again as a lead furnace in September, November, and December.

The Climax Molybdenum Co. at Climax, 14 miles north of Leadville, continued to mill at the rate of 44,000 tons a month to August 1, then 8,000 tons a month to December 1, and 15,000 tons in December, making a total for the year of 354,030 tons treated, which yielded 1,797 tons of molybdenite concentrate containing 1,913,375 pounds of elemental molybdenum.

Aspen (Pitkin County) continued to show the effect of the low prices of silver and lead; in 1931 its production was 37,169 ounces of silver and 282,000 pounds of lead and in 1932, 45,965 ounces and 228,000 pounds, respectively. Several cars of gold smelting ore from the old Independence district gave Pitkin County a gold production of \$1,092.

The silver mines of Mineral County (Creede), which ceased to operate after July 1930, remained idle in 1932.

The United States Vanadium Co. 140-ton roasting, leaching, and precipitation mill at Rifle was operated continuously to July 1, 1932, on ore from its vanadium mines 12 miles from Rifle; the mine was then abandoned.

In Gunnison County small shipments of gold bullion were made to the Denver Mint from the Maple Leaf mine near Parlin and from the Carter mine, at Ohio City; development work only was done at White Pine; some new development work was done at Powderhorn.

GOLD, ETC., IN COLO., N.MEX., TEX.,

Production in Summit County in 1932 was shipments of lead-silver smelting ore from Breckenridge, gold-silver bullion from the Tiger Amalgam ridge, and placer gold-silver bullion from the Co. dredge on Blue River, below Breckenridge. Licking and sluicing operations on Blue and S.

Gold production (recoverable) in Park County was \$871,789 in 1931 to \$2,599,412 in 1932 as the result of shipments of gold ore from the American Extension. Other producers were the "North Hocking" (silver-gold), Magnolia, or "West London." Development work was done at Mountain, Ophir, and Weber groups.

Clear Creek County yielded \$119,876 in gold and silver, chiefly from the operations of the Leadville Mines near Idaho Springs. Gilpin County produced gold, principally from the operations of the City. Other producers in Gilpin County were Toga, and Perigo. Small lots of bullion were marketed from Boulder County mines in 1932 and 11,737 ounces of silver.

NEW MEXICO

In 1932 the output of gold, silver, copper, and lead from New Mexico ores and gravels, in terms of recoverable metal, was 23,930 ounces of gold, 1,288,899,000 pounds of copper, 20,951,000 pounds of silver, 51,108,000 pounds of zinc. Compared with 1931, a decrease of 7,231 ounces of gold, an increase of 1,586,000 pounds of lead, and a decrease of 1,586,000 pounds of lead, and a decrease of 1,586,000 pounds of lead, and a decrease of 1,586,000 pounds of lead. The gross value of the New Mexico metal products was as follows: Gold \$494,669, silver \$335,707, copper \$628,530, and zinc \$1,533,240, a total of \$9,494,766 in 1931.

Mine production of gold, silver, copper, lead, and zinc in terms of recovered metal

Year	Gold (lode and placer)		Silver (lode and placer)
	Fine ounces	Value	Fine ounces
1928.....	32,912.41	\$680,360	827,750
1929.....	25,176.46	727,162	1,121,540
1930.....	32,870.42	669,156	1,107,330
1931.....	31,161.24	644,180	1,041,820
1932 ¹	23,929.62	494,669	1,190,460

Year	Lead	
	Pounds	Value
1928.....	15,610,501	\$905,400
1929.....	22,260,811	1,402,400
1930.....	20,758,900	1,037,800
1931.....	22,637,000	833,800
1932 ¹	20,951,000	628,500

¹ Subject to revision.

The large low-grade porphyry copper deposit of the Chino Mines of the Nevada Consolidated Copper Co. at Santa Rita was mined at the rate of 6,474 tons daily for 180 days in 1932 compared with 7,178 tons in 1931 (actually 8,852 tons for 296 days). The deposit is mined by open-pit methods, using steam and electric shovels, and the ore is concentrated at the company flotation mill at Hurley, which has a daily capacity of 15,000 tons in all seven units. The Lordsburg district, the second largest gold and copper producer in the State in 1931, in 1932 shipped 16,608 tons of siliceous copper-gold-silver ores, containing 1,404 ounces of gold, 37,561 ounces of silver, 936,100 pounds of copper, and 59,284 pounds of lead, compared with 96,032 tons in 1931, which contained 11,287 ounces of gold, 137,731 ounces of silver, 4,725,223 pounds of copper, and 186,196 pounds of lead. As usual, the ore was shipped to Douglas, Ariz., and El Paso, Tex. The largest producing mine in this district, the Eighty-Five, was closed soon after January 1, 1932. The only other producer in 1932 was the Bonney mine.

The Pecos mine of the American Metal Co. on Willow Creek, San Miguel County, in its sixth year of production, continued to produce at the rate of 538 tons a day. The ore minerals in this complex sulphide ore body are sphalerite, galena, chalcopryrite, and pyrite, and the gangue is a sheared micaceous diorite. The ore bodies are mined both by the cut-and-fill system and by square-set stopes. The mine and mill are connected by a 12-mile aerial tramway. The capacity of the mill, a selective flotation plant, is 600 tons a day. In 1932 the mill produced 44,681 tons of zinc concentrates and 17,665 tons of lead-copper concentrates compared with 44,780 tons and 18,911 tons, respectively, in 1931. The actual heads of ore into the mill in 1932 averaged 0.112 ounce of gold, 4.24 ounces of silver, 0.89 percent copper (wet assay), 4.89 percent lead (wet assay), and 15.50 percent zinc. This mine is the largest single producer of gold, silver, lead, and zinc in New Mexico. Other producers of zinc concentrates were the Black Hawk (or Combination) selective flotation mill at Hanover, which was operated continuously, and the Peru selective flotation mill at Wemple, near Deming, which was operated the last 3 months only. Zinc concentrates produced in New Mexico in 1932 amounted to 55,870 tons containing 61,576,492 pounds of zinc and averaging 55 percent zinc.

Several cars of silver-gold ore were shipped to the El Paso smelter from the Cochiti or Bland district, Sandoval County; several shipments of gold-silver concentrate were made from the Mogollon district, Catron County; and several small shipments of gold-silver ore were made from Tres Piedras and from Red River, Taos County. Small lots of placer gold bullion were shipped from the Mt. Baldy district, Colfax County; the Pinos Altos district, Grant County; the Jicarilla district, Lincoln County; the Hillsboro district, Sierra County; the Orogrande district, Otero County; and the Golden district, Santa Fe County.

TEXAS

Although no output of gold, silver, copper, or lead was recorded for Texas in 1931 a small output of each of these metals was reported in 1932. As shown in the accompanying table \$180 in gold, 1,421 ounces of silver, 7,000 pounds of copper, and 34,000 pounds of lead were recovered, with a combined gross value of \$2,042.

GOLD, ETC., IN COLO., N.MEX., TEX., S.

Mine production of gold, silver, copper, and lead in recovered metals

Year	Ore (short tons)	Gold	Silver		Copper	
			Fine ounces	Value	Pounds	Value
1928.....	70,915	\$10,115	1,340,622	\$784,204	447,702	\$04
1929.....	63,872	20,439	1,020,510	543,935	341,000	80
1930.....	31,147	3,048	389,239	140,857	143,100	18
1931.....	185	180	1,421	401	7,000	

¹ No production was recorded for 1931; figures for 1932 subject to revision.

The metals produced in Texas in 1932 were in El Paso County, and Allamore, Culbertson County.

SOUTH DAKOTA

The metal mines in South Dakota in 1932 produced 126,199 ounces of silver, and 7,000 pounds of copper, each of the three metals over 1931.

The Homestake mine at Lead, Lawrence County, is the largest producing gold mine in the United States, with a production of 1,401 ounces of gold in 1932. The company report showed 1,401 ounces of gold, 1,401 pounds of silver, and 1,401 pounds of copper, all of which were produced from gold-silver bullion treated by an cyanidation of sands and slimes were \$9,911. The total value of the bullion and concentrates which brought \$23,662,296. From 1876 to 1932, inclusive, the mine has produced \$62,653,292 in dividends.

Mine production of gold, silver, and lead in South Dakota in recovered metals

Year	Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
		Fine ounces	Value	Fine ounces	Value
1928.....	1,422,233	317,378.94	\$6,500,805	90,547	\$5,182
1929.....	1,403,159	310,836.85	6,540,599	85,182	4,182
1930.....	1,365,156	407,221.14	8,418,008	105,236	4,182
1931.....	1,404,153	432,075.39	8,931,791	113,582	3,182
1932 ¹	1,401,664	480,329.74	9,929,297	126,199	3,182

¹ Subject to revision.

Ore milled, receipts, and dividends, Homestake mine

Year	Ore milled
1928.....	Short tons 1,416,949
1929.....	1,437,935
1930.....	1,364,450
1931.....	1,403,939
1932 ¹	1,401,693

¹ Subject to revision.

In 1932 placer gold production in South Dakota totaled 1,148.14 fine ounces, chiefly from the Grand Hills Mining Co. steam shovel Ainalay bowl installation on French Creek near Custer, the scene of the first discovery of gold in South Dakota in 1874. Other placer production was from a gasoline shovel and sluicing at Tinton and small-scale placers on Battle, Bear, Castle, French, Spring, and Whitewood Creeks. From 1875 to 1932, inclusive, South Dakota has yielded \$308,084,819 in gold and 8,009,825 ounces of silver.

In 1932 the production of lead in South Dakota, in terms of recovered metal, was 7,000 pounds, from a car of concentrates from the Sitting Bull-Richmond mill.

WYOMING

Metal mines in Wyoming in 1932 reported production of \$5,129 in gold, 195 ounces of silver, and 9,000 pounds of lead. These metals had a gross value of \$5,454 compared with \$1,989 for the State in 1931.

The bulk of the gold production of Wyoming in 1932 was from shipments of amalgamation and placer bullion from Atlantic City, Fremont County. One car of lead-silver ore was shipped from Encampment, Carbon County.

Mine production of gold, silver, copper, and lead in Wyoming, 1928-32, in terms of recovered metals

Year	Ore (short tons)	Gold	Silver		Copper		Lead		Total value
			Fine ounces	Value	Pounds	Value	Pounds	Value	
1928.....	129	\$677	53	\$31	2,604	\$376			\$1,093
1929.....	143	995	26	14	4,301	757			1,766
1930.....	1,285	9,188	122	47	11,600	1,508			10,713
1931.....	23	1,105	17	5	9,000	819			1,989
1932 ¹	80	5,129	195	55			9,000	\$270	5,454

¹ Subject to revision.

GOLD, SILVER, COPPER, LEAD, AND ZINC AND CENTRAL STATES

(MINE REPORT)

By J. P. DUNLOP AND H.

Mines of the Eastern and Central States valued as follows: Gold, \$21,854; silver, \$8,381,280; and zinc, \$16,008,210. Both quantity and value of all these metals was only about \$2,000 less than in 1931; to the smaller quantity of copper ore mined.

The value of metal production herein is at the figures given in the table on page 145, mint value for fine gold; that is, \$20.67 valued at the average buying price at New York. Copper, lead, and zinc prices are weighted at the average of primary metal sold by producers.

Salient statistics of mine production of gold, silver, copper, lead, and zinc in the Eastern and Central States in 1932, by State

State	Ore, old tailings, etc., sold or treated	Gold (lode and placer)	Silver (lode and placer)
	Short tons		Fine ounces
Eastern States:			
Alabama.....	800	\$1,423	10
Georgia.....	440	5,760	30
New Jersey.....	559,651		
New York.....	189,679		
North Carolina.....	20,660	7,591	10,045
Pennsylvania.....	69,811	1,660	830
South Carolina.....	180	1,408	5
Tennessee.....	852,846	3,315	10,300
Virginia.....	304,773	637	8
Total, 1931.....	1,998,849	21,854	30,228
	3,255,618	23,827	63,949
Central States:			
Arkansas.....	(¹)		
Illinois.....	(²)		267
Kansas.....	750,600		
Kentucky.....	(³)		
Michigan.....	1,142,775		71,408
Missouri.....	3,786,000		1,128
Oklahoma.....	1,687,700		
Wisconsin.....	310,200		
Total, 1931.....	7,577,875		72,793
	14,871,948		42,737

¹ Estimated smelting value of recoverable zinc content of ore; smelting charges are added.

² New York and Virginia included under Tennessee; Bureau of Mines figures.

³ Excludes value of lead, which is included under Tennessee; North Carolina and Pennsylvania included under Tennessee; separate figures.

⁴ Excludes value of copper, which is included under Tennessee; Virginia included under Tennessee; Bureau of Mines not available.

⁵ Includes also value of copper from North Carolina and Pennsylvania, and zinc from Virginia.

⁶ Excludes value of lead and zinc, which is included under Tennessee.

⁷ No estimates available for small quantity of ore treated in 1932.

Prices of silver, copper, lead, and zinc, 1928-32

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	<i>Per fine ounce</i>	<i>Per pound</i>	<i>Per pound</i>	<i>Per pound</i>		<i>Per fine ounce</i>	<i>Per pound</i>	<i>Per pound</i>	<i>Per pound</i>
1928.....	\$0.585	\$0.144	\$0.058	\$0.061	1931.....	\$0.290	\$0.091	\$0.037	\$0.038
1929.....	.533	.176	.063	.066	1932.....	.282	.063	.030	.030
1930.....	.385	.130	.050	.048					

Gold and silver.—The output of gold in the Eastern States was valued at \$21,854 in 1932, or \$1,973 less than in 1931. Placer mines yielded 226.88 fine ounces of gold in 1932 compared with 166.12 ounces in 1931. Gold derived from siliceous ores increased from 90.36 ounces in 1931 to 459.04 ounces in 1932. Gold derived from the refining of copper bullion decreased from 896.15 ounces in 1931 to 371.27 ounces in 1932. More than twice as many placer and lode gold mines were operated in 1932 as there were in 1931. Small yields of gold were reported in 1932 by 15 lode gold mines and 20 placers. Numerous other properties were being prospected, old mines were reopened, and experimental mills were built, indicating a considerable increase in gold from the Southern Appalachian States in 1932. In 1932 about 2,200 tons of siliceous ore were treated at mills in Alabama, Georgia, North Carolina, South Carolina, and Virginia; in 1931 lode mines were productive only in Georgia and North Carolina. The value of the estimated output of gold in the Southern Appalachian States from 1799 to 1932, inclusive, is recorded as \$51,243,198.

Mines in the Central States yielded no gold.

Of the silver (30,228 ounces) produced in the Eastern States in 1932 all except 21 ounces from placer bullion and 77 ounces from lode gold mines was derived from copper bullion recovered from copper ore and copper concentrates from mines in North Carolina, Pennsylvania, and Tennessee. As the copper output in the Eastern States decreased in 1932 the silver output was less than half that in 1931.

Production of silver in the Central States in 1932 was 72,793 ounces. The output of Illinois was from lead concentrates recovered in mining fluorspar, that of Missouri was from zinc concentrates derived from milling lead ore, and that of Michigan was from copper ore. Lead, zinc, and lead-zinc ores mined in Kansas, Oklahoma, and Wisconsin contain no appreciable quantity of silver.

Copper.—The mine production of copper in the Eastern States in 1932 was 10,872,200 pounds, valued at \$684,949, a decrease of 12,573,800 pounds from that in 1931; each of the producing States showed a decrease. The output was derived from copper ore mined in North Carolina and Tennessee and from copper concentrates recovered from Pennsylvania pyritiferous magnetite ore mined for its iron content. The copper ore yielded \$0.06 to the ton in gold and silver. The copper concentrates from magnetite ore contained about 20.1 percent copper and \$2.42 to the ton in gold and silver.

All the copper produced in 1932 in the Central States was from mines in Michigan; no copper ore or residues containing copper were shipped from mines or smelters in Missouri. The output of refined copper in Michigan was 54,396,108 pounds in 1932 compared with 118,059,491 pounds in 1931. The average recovery of copper per ton of rock treated increased from 33.1 pounds in 1931 to 47.6 pounds in 1932.

Lead.—The output of lead from mines in all from lead-zinc ores from the Austinville Balmat mine in New York, and the Embury mine in Missouri. Lead concentrates shipped amounted to 7,299 tons in 1932 compared with 13,210 tons in 1931.

The lead recovered from mine shipments in the Central States decreased from 135,228 tons in 1932. Missouri shipments of lead, of which 116,152 tons were from mines in Missouri, decreased from 13,210 tons in 1931 to 6,490 tons in 1932. Wisconsin produced ore yielding 952 tons of lead in 1932. Only a few cars of lead concentrates were shipped from Illinois. The output of lead from Arkansas mines in 1931 to 4 tons in 1932. Mines in the region shipped 23,523 tons of lead concentrates in 1932 compared with 18,131 tons of recoverable lead.

Zinc.—The recoverable zinc in ore and concentrates from mines in the Eastern States was 116,768 tons in 1932, compared with 156,697 tons, valued at \$7,993,650. Mines in New Jersey yielded 81,460 tons, as compared with 100,000 tons in 1931.

[N.B.—The value of the zinc in New Jersey is not the estimated smelting value of the recoverable zinc but the value of the zinc after deducting freight, haulage, smelting, and manufacturing charges.]

Mines in New York shipped concentrates, partly from lead-zinc ore, from which 16,770 tons of zinc were recovered. Zinc sulphide ores yielded nearly 100 percent zinc. Zinc concentrates from Tennessee, and all the ore was concentrated except zinc carbonate. The recovered zinc output from mines in Virginia may not be the recoverable zinc content of concentrates shipped from Virginia was 18,514 tons, less than 50 percent of the output in 1931. Some of the zinc concentrates made at the mines. The zinc concentrates shipped from the States in 1932 totaled 580,352 tons, including zinc carbonate from Tennessee and Virginia and zinc concentrates from New Jersey.

Shipments in the Central States had a record of 108,268 tons in 1932 compared with 130,476 tons in 1931. The Tri-State or Joplin region shipped ore and concentrates valued at \$1,906,660 in 1932 compared with \$1,906,660 in 1931. Mines in Oklahoma contributed 29 percent of the zinc from the Tri-State region. The zinc recovered from mines in Wisconsin was 7,522 tons in 1932, and that of Missouri decreased from 3,205 tons in 1931 to 986 tons in 1932. Zinc carbonate and silicates yielding 46 tons of zinc were shipped from mines in Kentucky. No ore or concentrates were shipped from mines in Arkansas or Illinois in 1932.

REVIEW OF MINE PRODUCTION IN THE EASTERN AND APPALACHIAN STATES

Alabama.—The value of the gold produced in Alabama from 1830 to 1932, inclusive, is recorded as \$769,229. In 1932 there was a revival of lode mining, and the mines yielded \$1,423 in gold and 10 ounces of silver. Most of this was from the W. F. Pasley mine near Alexander City, Tallapoosa County; the mine is equipped with a cyanide plant.

Georgia.—The value of the gold produced in Georgia from 1830 to 1932, inclusive, is recorded as \$17,859,439. In 1932, 11 small placer mines and 3 lode mines yielded \$5,760 in gold and 30 ounces of silver; in 1931, 2 mines produced \$1,827 in gold and 12 ounces of silver. Placer mines near Dahlonega and Auraria in Lumpkin County yielded nearly 80 percent of the State output of placer gold (\$3,720) in 1932; the remainder was produced by small mines operating in Cherokee, Dawson, Douglas, Gwinnett, and Hall Counties. The lode gold mines producing in 1932 were the Russell near Cleveland in White County, the Arnold near Lexington in Oglethorpe County, and the Hamilton at Thomson in McDuffie County. The Hamilton mine and mill were operated by W. H. Fluker, who sank two shallow shafts and did considerable drifting. The ore milled was taken out during development and treated at a 5-stamp mill. It is stated that amalgamation recovered only 60 percent of the gold content of the ore, whereas tests showed that cyanidation would recover a much larger proportion. The Hamilton mine adjoins the old Parks and Columbia mines which have yielded considerable gold and are now being reopened. The Russell mine was operated by Telford and Kenimer, and the gold ore was treated at a small mill. The Arnold mine is opened by a shaft and drifts, and the small quantity of ore mined yielded about \$9 a ton in gold. The Chestatee placer mines and the Barlow, Findley, and other properties of Craig R. Arnold in the Dahlonega district are optioned and are to be developed in 1933.

Maine, Maryland, New Hampshire, and Vermont.—There was no production of gold, silver, copper, lead, or zinc in these States in 1932.

New Jersey (see also note on p. 147).—The production of zinc ore in New Jersey in 1932 was 559,651 tons containing 162,920,000 pounds of recoverable zinc. The only producing properties were the Mine Hill and Sterling Hill mines of the New Jersey Zinc Co.

New York.—The quantity of zinc ore and old tailings milled in New York in 1932 was 72,615 tons, and the quantity of lead-zinc ore was 117,064 tons; the concentrates shipped yielded 16,794 tons of zinc. The mines were not operated at capacity in 1932, and the shipments of concentrates were only about two thirds of those in 1931. The old Edwards mine yields sulphide zinc ore and is equipped with a 450-ton all-flotation plant. The Balmat mine near Sylvan Lake yields sulphide lead-zinc ore with a recovery of about 1 ton of lead concentrates to 10 tons of zinc concentrates and has a 600-ton flotation plant.

North Carolina.—The value of the gold produced in North Carolina from 1799 to 1932, inclusive, is recorded as \$23,698,278. The yield of gold in 1932 was \$7,591 and that of silver 10,045 ounces. Six placer mines yielded \$449 in gold and nine lode mines \$7,142. The placer mines were worked on a small scale. The Fontana copper mine

was the largest producer of gold from lode mines in 1932. The gold was recovered in Burke, Gaston, Halifax, and Warren Counties. Lode mines were productive in Cabarrus, Montgomery, Randolph, Stanly, Swain, and Union Counties. The gold mines were all small producers, and less than 100,000 ounces of gold were milled in 1932; properties that produced gold were Hearne and Sibley in Cabarrus County, operated by the Crayton, also in Cabarrus County; the Jackson mine in Jackson County, where rich gold ore was mined by Lindsey in Guilford County, operated by the Ankle in Montgomery County near Seagrove, where a vertical shaft and open cuts and where a new mill is under construction; the Kindley near Fullerton, also in Montgomery County, equipped with a ball mill; the Whitley near Union County, equipped with a 10-stamp mill operated by the Rogers near Waxhaw in Union County; the Strother, from which ore was shipped to the Terry & Holler are erecting a new 10-stamp mill in Mecklenburg County, and H. H. Green has a mill at Gold Hill in Rowan County. The North Carolina Co. shipped crude sulphide copper ore from Swain County to the Tennessee Copper Co. in Tennessee. The crude ore assays 0.01 ounce of gold silver to the ton. The Fontana mine is operating on a 80-foot shaft.

Pennsylvania.—The Cornwall mines in Pennsylvania operated at a much reduced rate in 1932, and only a small amount of copper concentrates was shipped as in 1931. The pyritiferous magnetite, and the tailings from the Cornwall mine to the flotation plant. The copper concentrates about 20.1 percent copper and \$2.42 to the ton were shipped to the Nichols Copper Co.

South Carolina.—From 1829 to 1932, in South Carolina yielded \$5,184,753 in gold. The output of which \$947 came from lode gold mines. The placer in 1932 was the Brewer near Jefferson, operated by J. F. Hartman. Smaller yields were from Bogan and by E. C. Young. Some gold was produced at the old Haile mine in Lancaster County near Rock Hill. The output was from the Notts mine in Union County. This old mine, idle since 1900, was reopened by Cannon. The 10-stamp mill was operated on ore from old dumps, but some good ore was recovered from an 80-foot shaft.

Tennessee.—Mines in Tennessee produced \$1,831 to 1932, inclusive. Almost the entire output has been from copper ores. There were large quantities of copper, zinc, gold, and silver from mines in 1932. The output of gold decreased from \$8,325 in 1931 to \$7,591 in 1932. The silver from 41,000 to 19,300 ounces. There was little lead, but the quantity recovered in 1932 was 10,045 ounces. The total lead recovered from mines in Tennessee and Tennessee in 1932 was 4,460 tons, and from mines in Tennessee and Virginia (for w

not be given) was 18,514 tons. The output of copper from mines in North Carolina, Tennessee, and Pennsylvania was 10,872,200 pounds, a decrease of nearly 12,474,000 pounds from 1931. The Tennessee Copper Co. ran its flotation plant and smelter on ore from the Polk County, Burra-Burra, and Eureka mines in Tennessee and on crude sulphide ore from the Fontana mine in Swain County, N.C.; the company mines were operated 191 days, the flotation plant was operated 173 days, and the smelter was operated full time on reduced tonnage. The Ducktown Chemical & Iron Co. operated its Isabella and East Tennessee mines and its flotation plant part of the year; it did not operate its smelter but stored the copper concentrates. The Mascot mine and mill of the American Zinc Co. of Tennessee were operated at about 80 percent of the 1931 rate. The Universal Exploration Co. did not mine any zinc carbonate ore in 1932 but kept its 800-ton all-flotation plant running on zinc sulphide ore at a lower rate than in 1931; the blende concentrates shipped had an average zinc content of 64.83 percent—the highest grade zinc concentrates reported in 1932. The Embree Iron Co. in Washington County shipped much less high-grade zinc carbonate than in 1931 but more lead carbonate.

Virginia.—The value of gold produced from mines in Virginia from 1828 to 1932, inclusive, is recorded as \$3,299,073, of which only about \$9,800 was produced during the last 22 years. In 1932 Virginia produced \$637 in gold and 8 ounces of silver—the first output of gold since 1926. Shipments of lead and zinc concentrates decreased sharply in 1932. As there were only two producers of zinc and one of lead the Bureau of Mines is not at liberty to publish the figures. Sulphide lead-zinc ore was mined at the Austinville mine of the Bertha Mineral Co. The Ivanhoe Mining & Smelting Co. mined some oxidized zinc ore from shallow shafts. The gold and silver came from the Moss mine near Tabscott, Goochland County, operated by J. C. Williams and others. A 150-foot shaft was completed in July 1932, and a small stamp mill was operated for a few days on ore taken out during development. Part of the ore developed probably is not amenable to treatment by amalgamation and must be shipped to a smelter. Development work was continued in 1932 by Leo Faust on the Waller mine near Tabscott. The vertical shaft is down more than 300 feet. Some good ore is reported at the 150-foot level, but no effort will be made to mill the ore until drifts are run at the 300-foot level to cut other veins and until tests are made to indicate the proper method of treatment. The Moss and Waller mines are only 2 miles apart, in the James River area about 40 miles from Richmond.

REVIEW OF MINE PRODUCTION IN THE CENTRAL STATES

Tenor of ores.—The only fair basis for comparison of the relative magnitude of mining operations in different States is that of quantity of crude ore or "dirt." There are, however, marked differences in the metal content of the ores of the several mining regions and States; therefore, comparison of tenor of the ores is of interest and significance. All but a very small part of the ore from the Central States is of such tenor that it requires concentration. In Kentucky and southern Illinois most of the lead and zinc concentrates are recovered as by-products in the concentration of the fluorspar that they accompany,

and it is not possible to calculate the metal content of the ore raised. In Arkansas very little ore has been mined in recent years, and the average tenor calculated from the few years would not present an accurate comparison during a period of active mining.

Quantity and tenor of copper, lead, and zinc ores, old and new, in the Central States, 1930-32, by State.

State	1930		1931
	Ore, etc.	Metal content ¹	Ore, etc.
	Short tons	Percent	Short tons
Kansas.....	3,517,300	2.86	1,913,200
Michigan.....	6,659,038	1.27	3,670,700
Missouri.....	7,010,100	3.08	5,240,400
Oklahoma.....	7,213,600	2.61	3,828,900
Wisconsin.....	486,400	3.66	318,700
Total.....	24,886,436		14,871,900

¹ The percentages represent the metal content of the ore insofar as it is recoverable. In Michigan the metal so recovered is copper; in the other Central States the relative proportions of which are shown in the table on p. 145 and in the sections devoted to the respective States.

Production of lead and zinc by regions.—The 1930 gives the areas included in the seven regions of the Central States. Mineral Resources gives brief reviews of the history of lead and zinc in the Central States, the yearly production of each State, inclusive, and historical notes and estimates of lead and zinc in each State before 1907.

Mine production of lead and zinc in the Central States, 1930-32, by region

Region	Lead ¹	
	Short tons	Value
Concentrates:		
Joplin.....	23,523	\$830,500
Southeastern Missouri.....	162,989	4,891,900
Upper Mississippi Valley ²	1,312	38,400
Kentucky-southern Illinois.....	66	1,300
Northern Arkansas.....	6	100
Total, 1931.....	187,886	5,768,500
	253,588	11,160,700
Metal:		
Joplin.....	18,131	1,087,800
Southeastern Missouri.....	110,162	6,909,100
Upper Mississippi Valley ²	910	64,800
Kentucky-southern Illinois.....	31	1,800
Northern Arkansas.....	4	200
Total, 1931.....	135,228	8,113,600
	181,648	13,441,900

¹ Includes both galena and a small quantity of lead carbonate concentrates.

² Includes sphalerite and a small quantity of zinc carbonate and zinc silicate.

³ Includes Iowa, northern Illinois, and Wisconsin.

Arkansas.—No zinc ore or concentrates were shipped by mines in Arkansas in 1932, and shipments of galena concentrates were only 6 tons, yielding about 4 tons of lead. In 1931 the lead output was 78 tons. No zinc mines were operated in 1932, and all the lead ore shipped was from the Brewer land in Newton County.

Illinois.—None of the zinc or lead mines in northern Illinois were operated in 1932, and the only shipments from mines in southern Illinois were 56 tons of galena concentrates having an average lead content of 55.4 percent. The recoveries from these shipments were 31 tons of lead and 257 ounces of silver. The output in 1931 was 205 tons of lead and 1,300 ounces of silver. The Hillside Fluor Spar Mines was the largest shipper of galena concentrates in 1932, and all the concentrates were sold to the St. Louis Smelting & Refining Co. plant of the National Lead Co. The Rosiclare and Franklin mines, producing mainly fluor spar, did not sell any lead concentrates in 1932.

Kansas.—The output of recovered lead and zinc in Kansas in 1932 was much less than in 1931, although considerable quantities of concentrates milled in 1931 were shipped in 1932. The recovered lead in concentrates shipped decreased from 7,082 tons in 1931 to 6,490 tons in 1932 and recovered zinc from 39,051 to 26,277 tons.

The total quantity of zinc and lead-zinc ore and old tailings milled in Kansas in 1932 was 750,500 tons (1,913,200 tons in 1931), and the total shipments were 8,300 tons of galena concentrates, 79 tons of lead carbonate, and 49,487 tons of sphalerite concentrates. The galena concentrates had an average lead content of 79.3 percent, and the sphalerite concentrates had an average zinc content of 60.3 percent. The following average prices were received by sellers of concentrates: Galena concentrates \$39.20 a ton, and sphalerite concentrates \$17.97 a ton. The 507,100 tons of crude ore milled yielded 0.91 percent in galena concentrates assaying 79.3 percent lead and 7.03 percent in sphalerite concentrates averaging 60.4 percent zinc. The 243,400 tons of old tailings re-treated yielded only 4 tons of galena concentrates but contained 2.01 percent in sphalerite concentrates with an average assay of 59.5 percent zinc.

The total concentrates made by flotation in 1932 were 13,400 tons of sphalerite and 290 tons of galena.

Of the total shipments of sphalerite (49,487 tons), mines near Crestline contributed 11 tons and mines near Galena 27 tons; the remaining 49,449 tons were shipped from mines in the Blue Mound-Baxter Springs area. This area also contributed 7,529 tons of galena concentrates. Mines at Galena shipped 547 tons of galena and 79 tons of lead carbonate concentrates, and mines at Crestline shipped 224 tons of galena.

In the Crestline area all the large mills were idle in 1932, and most of the galena shipped was from stocks at mines. In the Galena camp most of the concentrates shipped were produced by small gougers on leases of the Eagle-Picher Mining & Smelting Co.

GOLD, ETC., IN EASTERN AND CENTRAL

Mine production of lead and zinc in Kansas

Year	Lead concentrates ¹		Zinc concentrates		Lead	
	Short tons	Value	Short tons	Value	Short tons	Value
1931.....	9,283	\$404,231	73,690	\$1,651,992	7,082	
1932.....	8,379	327,344	49,487	889,066	6,490	

¹ Includes 79 tons of lead carbonate, containing 56 percent lead, from Galena carbonate, containing 57 percent lead, in 1931.

² In calculating the metal content of the ores from assays allowance has been made for both lead and zinc. In comparing the values of ore and metal it should be given for the ore is that actually received by the producer, whereas the value calculated from the average price for all grades.

Tenor of lead and zinc ore and old tailings milled and concentrates shipped in Kansas, 1931-32

	1931	
	Crude ore	Old tailings
Total ore and old tailings milled.....short tons..	1,040,800	87,000
Total concentrates shipped:		
Galena.....do.....	8,882	
Sphalerite.....do.....	55,537	
Ratio of concentrates to ore, etc.:		
Lead.....percent.....	0.94	
Zinc.....do.....	6.30	
Metal content of ore, etc.:		
Lead.....do.....	.73	
Zinc.....do.....	3.80	
Average lead content of galena concentrates.....do.....	79.3	
Average zinc content of sphalerite concentrates.....do.....	60.4	
Average value per ton:		
Galena concentrates.....	\$44.99	
Sphalerite concentrates.....	\$23.26	

The mines near Baxter Springs shipped 1,225 tons of sphalerite. Of this quantity, about 6,112 tons of sphalerite. Little prospecting was done in 1932. Only new mill erected was a 100-ton plant of the Co. The principal shippers in the area in 1932 were Co. (tailing mill), Lucky O. K. Mining Co., V. J. (Hartley-Grantham mine), H & B Mining Co., Mining Co. (Hartley mine), and Lowther & Co.

The mines in the Blue Mound area, which in 1932 shipped 60,304 tons of sphalerite, had an output in 1932; shipments, including a large quantity of a smaller proportion of sphalerite from mine bins, tons of galena and 43,337 tons of sphalerite in shippers in this area were the Jay Hawk Mining Inc. (tailings), Black Eagle Mining Co. (ore and Mining & Royalty Co. (Webber, West Side, Eagle-Picher Mining & Smelting Co. (Bendel, tinent Lead & Zinc Corporation and Vinegar mine).

The Waco district (in Kansas) shipped 2,063 tons of sphalerite in 1931; all mines and mills were idle in 1932, and no shipments were made from stocked concentrates.

Kentucky.—The fluor spar mines in Kentucky made no shipments of lead concentrates in 1931 or 1932. Shipments in 1930 were 184 tons having a recoverable content of 101 tons of lead.

Shipments of 137 tons of zinc carbonate and silicates were made in 1932 from mines near Marion, by Roberts & Frazer and Avery H. Reed; the recovered zinc content was 46 tons. The ore mined by Avery H. Reed is a mixed zinc carbonate and lead carbonate.

Michigan.—In 1932 the mines of Michigan produced 1,142,775 tons of rock yielding 79,753,030 pounds of mineral, from which 54,396,108 pounds of refined copper were obtained. The production was less than half that recorded for 1931. Adverse industrial conditions throughout the world caused a severe contraction in demand for copper, and an unfavorable balance between supply and demand resulted. A new low price for copper was established in 1932, and virtually all copper mines in the country were operated at a loss. Owing to these conditions the Michigan State Tax Commission reduced the assessed valuation of the mines in Houghton and Keweenaw Counties during the year from \$28,562,661 to \$19,992,470; Houghton County mines were valued at \$14,132,470 compared with \$20,347,661 in 1931 and Keweenaw County mines at \$5,860,000 compared with \$8,215,000 in 1931. The assessed valuation of Calumet & Hecla properties in Houghton County was reduced from \$14,650,000 to \$10,580,000 and in Keweenaw County from \$5,575,000 to \$4,040,000. Copper Range was reduced from \$2,765,000 to \$1,900,000; Isle Royale from \$950,000 to \$645,000; Quincy from \$900,000 to \$435,000; Arcadian from \$50,000 to \$25,000; La Salle from \$80,000 to \$25,000; Superior from \$20,000 to \$10,000; Mohawk from \$1,850,000 to \$1,380,000; Seneca from \$700,000 to \$350,000; and Douglass Copper from \$40,000 to \$30,000.

Mining companies in Michigan made every effort to reduce the cost of production by selective mining, abandonment of exploration and construction work, reduction in salaries and wages, etc. The grade of rock mined increased from 1.27 percent in 1930 to 1.65 percent in 1931 and to 2.38 percent in 1932. Selective mining and the failure of the Calumet & Hecla Consolidated Copper Co. to treat copper sands in 1931 and 1932 were responsible for this increase. The average grade of rock for the district in 1932 was considerably higher than in any previous year since the compilation of mine figures was begun by the U. S. Geological Survey in 1906, due principally to the mining of high-grade rock from shaft pillars and old backs in the conglomerate branch of Calumet & Hecla. According to Butler and Burbank,¹ who recorded the grade of rock produced by individual mines in the Lake Superior district from 1845 through 1925, this mine produced rock yielding 66.6 pounds of copper to the ton in 1897 (slightly higher than the 65.53 pounds reported for it in 1932) and produced no rock of such high grade after that time.

¹ Butler, B. S., and Burbank, W. S., The Copper Deposits of Michigan: U. S. Geol. Survey Prof. Paper 144, 1929, p. 80.

Mine production of silver and copper in Michigan

Year	Silver (fine ounces)	Copper ¹		
		Pounds	Yield Pounds per ton of ore ("rock")	Percent
1928.....	17,153	178,442,704	24.2	1.21
1929.....	20,795	180,402,218	24.5	1.23
1930.....	7,820	199,381,413	25.4	1.27
1931.....	1,437	118,059,401	33.1	1.65
1932.....	71,408	54,396,108	47.6	2.38

¹ The figures are based on the actual recovery of copper from "mineral" that was not smelted during the year.

² Includes copper from sands.

³ Includes "mineral" from sands.

⁴ Includes sands.

⁵ No sands reported for 1931 or 1932.

Value of silver and copper produced in Michigan

Year	Silver	Copper		Total	Year	Silver
		Total	Per ton of ore ("rock")			
1928.....	\$10,035	\$25,095,749	\$3.49	\$25,705,784	1931.....	\$417
1929.....	11,084	32,806,790	4.32	32,817,874	1932.....	20,137
1930.....	3,011	22,019,584	3.31	22,022,595		

During 1932 the mines of the Calumet & Copper Co. produced 32,354,000 pounds of copper sold (not including depreciation and depletion) compared with 72,367,000 pounds of copper in 1931 sold of 9.77 cents a pound. The reclamation and Hubbell were both idle in 1931 and 1932. The branch, mining of shaft pillars and old backs extended into zones of the mine where the rock is of richer grade and raised the grade of rock for the entire branch to the ton in 1931 to 65.53 pounds in 1932. The average grade of rock for the district in 1932 was 48.69 pounds per ton. Because of the low price of copper in January 1933 production was confined to the old backs, and the lower part of the mine was permitted to remain idle throughout 1932. Closer selection in the stopes of the Ahmeek mine resulted in rock from that mine slightly; operations were suspended. The Osceola amygdaloid branch was closed and remained idle throughout 1932. At the Calumet conglomerate rock were stamped, and at the Ahmeek amygdaloid rock were treated. Reconstruction was under way when the mine and mill were closed and treated 22,000 tons of concentrates and mass from the Hecla mines and 106 tons from the Isle Royale. 30,560,000 pounds of refined copper was produced.

71,100,000 pounds in 1931. Plants of the Lake Milling, Smelting & Refining Co. were idle throughout 1931 and 1932.

Operations at the property of the Isle Royale Copper Co. were continued on a curtailed basis until the latter part of April when the mine and mill were closed. Late in December the mine was allowed to fill with water.

Copper produced by the Isle Royale Copper Co., 1929-32

	1929	1930	1931	1932
Rock hoisted.....short tons	669,049	668,700	450,682	74,189
Rock-house discard.....do	154,025	158,438	97,007	15,878
Rock treated.....do	515,024	510,262	353,675	58,311
Cost of mining, transportation, stamping, and taxes per ton of rock.....	\$2.67	\$2.44	\$2.24	\$2.63
Refined copper produced.....pounds	10,864,085	10,659,413	7,731,418	1,403,142
Refined copper per ton of rock treated.....do	21.09	20.89	21.90	24.06

Production at the Champion mine of the Copper Range Co. was maintained at approximately 1,000,000 pounds a month in 1932, most of which came from the south end of the property. Operations at the north end were discontinued March 1, 1932. A total of 12,188,578 pounds of copper was produced at an average cost delivered, exclusive of depreciation and depletion, of 8.646 cents a pound. The Baltic and Trimountain mines were idle throughout the year. A total of 291,265 tons was stamped at the Champion mill in 1932. Work on electrical crushing to replace steam stamps was begun late in the year. The new crusher will have operating advantages over the steam stamps, and a substantial reduction in costs is anticipated.

Copper produced by the Champion mine of the Copper Range Co., 1928-32

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound ¹	Price received	Net profit
	Short tons	Pounds	Pounds	Cents	Cents	
1928.....	427,240	19,563,535	45.79	11.10	15.01	\$820,357.46
1929.....	446,804	20,660,701	46.24	11.76	17.94	1,267,685.97
1930.....	(²)	19,999,564	44.57	11.60	11.43	32,955.04
1931.....	404,830	17,721,270	43.77	9.754	8.2	451,450.25
1932.....	291,265	12,188,578	41.847	8.646	6.0	690,108.09

¹ Excludes depreciation and depletion.
² Figures not given.
³ Deficit.

⁴ Includes Baltic mine.
⁵ Deficit for the Copper Range Co.

Copper produced by the Baltic mine, 1928-32¹

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound ¹	Price received	Net loss
	Short tons	Pounds	Pounds	Cents	Cents	
1928.....	92,742	3,415,082	36.82	14.54	15.01	\$16,085.53
1929.....	53,833	2,127,926	39.53	21.27	17.94	62,339.97
1930.....	(²)	3,251,705	49.72	11.82	11.43	(³)
1931.....	(²)	(²)	(²)	(²)	(²)	(²)

¹ No production recorded for 1932.
² Excludes depreciation and depletion.
³ Net profit.

⁴ Figures not given.
⁵ Included with Champion mine in preceding table.

Copper produced by the Trimountain

Year	Rock stamped	Copper produced
	Short tons	Pounds
1928.....	38,950	1,275,515
1929.....	42,763	1,408,689
1930.....	(¹)	542,640

¹ No production recorded for 1931 and 1932.
² Excludes depreciation and depletion.
³ Figures not given.

At the property of the Mohawk Mining Co. were stamped and yielded 8,450,388 pounds of copper produced in 1932 was 5.16 cents with 7.038 cents in 1931. With the exhaust, this record low cost was obtained in production with freedom from development expenses. Mining operations were continued day and 6-day week until September 12, 1932, reserves and the increasing pressure of the no. 6 shaft, the only one in operation, the Mineral and mass from current production the year totaled 27,055,350 pounds and yielded copper. The 18,049,750 pounds of minerals in 1932 were estimated to contain 12,600,000 pounds of copper. At a stockholders' meeting on March 1, 1932, to proceed with liquidation of the company, the 1932 totaled \$1,120,750.

Copper produced by the Mohawk Mining Co.

Rock hoisted.....	
Rock stamped.....	
Product of mineral.....	
Copper in mineral produced.....	
Yield per ton of rock treated.....	
Cost per ton of rock hoisted ¹	
Cost per ton of rock stamped ²	
Operating cost per pound of refined copper ³	
Cost of taxes ⁴	
Cost of smelting, freight, and marketing product offices' expenses.....	
Total.....	

Operations at the mine of the Quincy Mining Co. September 22, 1931, and the mine remained idle.

Copper produced by the Quincy Mining Co.

Year	Copper rock and mass
	Short tons
1928.....	60,8
1929.....	207,8
1930.....	480,8
1931.....	(¹)

¹ No production in 1932.
² Not given in company report but indicated by other figures.
³ No report issued by company, but production of copper, as indicated.

⁴ Based on actual production costs from Jan. 1, 1932, to date of

Missouri.—The following tables show the production of lead and zinc in southwestern Missouri and the tenor of ore ("dirt") and concentrates from Missouri.

Mine production of lead and zinc in southwestern Missouri, 1931-32

Year	Lead concentrates				Zinc concentrates				Metal content ¹			
	Galena		Carbonate		Sphalerite		Silicate and carbonate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1931.....	1,254	\$51,673	440	\$13,985	3,600	\$70,371	377	\$4,700	1,171	\$86,654	1,085	\$150,800
1932.....	849	25,837	646	14,491	1,538	26,180	404	4,248	1,007	60,420	946	66,700

¹ In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in southwestern Missouri, 1929-32

	1929	1930	1931	1932
Total ore.....short tons.....	428,400	328,800	104,800	46,400
Total concentrates in ore:				
Lead.....percent.....	0.33	0.40	1.63	3.61
Zinc.....do.....	3.80	3.89	3.76	4.69
Metal content of ore:				
Lead.....do.....	.25	.31	1.15	2.48
Zinc.....do.....	2.26	2.25	2.16	2.60
Average lead content of galena concentrates.....do.....	76.3	76.0	74.6	75.6
Average lead content of lead carbonate concentrates.....do.....	60.0	60.0	59.1	59.6
Average zinc content of sphalerite concentrates.....do.....	60.3	60.0	58.6	59.6
Average zinc content of silicates and carbonates.....do.....	40.2	40.1	39.0	39.8
Average value per ton:				
Galena concentrates.....	\$92.31	\$59.39	\$41.21	\$30.43
Lead carbonate concentrates.....	61.36	53.42	31.78	22.43
Sphalerite concentrates.....	40.63	33.55	22.05	16.37
Zinc silicates and carbonates.....	21.24	24.00	12.63	10.61

Tenor of lead ore and concentrates in southeastern Missouri disseminated-lead district, 1929-32

	1929	1930	1931	1932
Total lead ore.....short tons.....	6,430,600	6,681,300	5,135,600	3,740,200
Galena concentrates in ore.....percent.....	4.31	4.15	4.36	4.36
Zinc content of ore.....do.....	.11	.13	.04	.01
Average lead content of galena concentrates.....do.....	72.7	73.0	72.4	72.7
Average value per ton of galena concentrates.....	\$75.61	\$59.60	\$43.93	\$30.01
Average zinc content of sphalerite concentrates.....percent.....	68.1	58.2	57.6	57.15
Average value per ton of sphalerite concentrates.....	\$39.44	\$18.89	\$17.86	\$16.25

Mine shipments of lead and zinc concentrates in southeastern and central Missouri, 1907-32

Year	Lead concentrates (galena)		Zinc concentrates			
			Sphalerite		Carbonate and silicate	
	Short tons	Value	Short tons	Value	Short tons	Value
1907-1929.....	5,853,746	\$382,041,262	25,335	\$948,639	10,285	\$233,634
1930.....	277,520	10,558,920	8,411	158,116		
1931.....	223,853	9,833,045	2,408	43,000		
1932.....	162,989	4,891,978	80	1,300		

The value of the silver, lead, and zinc shipment was \$7,089,018 in 1932 compared with \$ quantity of silver recovered from ore and concentrates declined from 40,000 ounces in 1931 to 1, quantity of recovered lead declined from 117,159 tons in 1932 and that of recovered zinc. The silver recovered came from residues derived from lead ore mined in southeastern Missouri lead concentrates (of which only 646 tons were shipped in 1932 compared with 225,547 tons in 1932, 162,989 tons were shipped from mines and averaged 72.7 percent lead; the recovered 116,152 tons in 1932 compared with 158,950 tons in 1931). Shipments of lead concentrates from Missouri comprised 849 tons of galena and 646 tons of carbonate in 1932. The average lead content of the galena from Missouri in 1932 was 75.6 percent, and the average value of galena sold mainly in small lots, was about \$30. The value of galena concentrates in the Tri-State area in 1932 was \$25,837 compared with \$51,673 in 1931, although indicating the trend of prices, did not reflect the price paid to sellers of galena concentrates. Sellers of galena quoted price or less, whereas sellers of zinc concentrates totaling several hundred tons, were paid \$16.37 a ton.

Practically all the zinc concentrates shipped in 1932 were from properties in southwestern Missouri; they amounted to 404 tons (compared with 404 tons in 1931) and averaged about 39.8 percent in zinc. Zinc silicate was a milled product as there was no demand for it and all was purchased at a flat price as there was no demand for it in 1932. The total value of lead and zinc concentrates from southwestern Missouri decreased from \$149,000 in 1931 to \$25,837 in 1932. The total value assigned for the 162,989 tons of lead concentrates shipped from southeastern Missouri was \$4,891,978 less than in 1931).

The quantity of crude ore and old tailings shipped in 1932 totaled 3,786,600 tons. The total amount of lead and zinc concentrates sold in 1932 was \$1.31 per ton of crude ore and old tailings (compared with \$1.31 per ton of crude ore and old tailings in 1931).

There was a very small demand for high-grade concentrates in 1932, and no premium was paid for them. The demand for lead-free zinc concentrates did not desire to purchase lead-free zinc concentrates containing more than 60 to 60.5 percent zinc. Zinc concentrates were purchased more eagerly than jig concentrates or change in preference of ore buyers is due to the fact that they are equipped to re-treat the concentrates.

lower prices and also save much of the lead contained in such zinc concentrates. The new and more efficient milling plants usually can make sphalerite concentrates averaging as high as 63+ percent in zinc content. The general average zinc content of the concentrates sold in the Tri-State region in 1932 was about 1 percent more than in 1931, notwithstanding the fact that a considerable part of the 1932 shipments were concentrates made in 1931. Several large mills which were producing 61 to 63 percent sphalerite concentrates are keeping the content at 60 percent or less, and the concentrates now held in mine bins include very little flotation products or low-grade jig and table concentrates. Prices quoted in 1932 were not paid for some of the zinc concentrates shipped in 1932, as they were sold under special contract, and a large quantity was shipped to smelters for smelting with the proviso that the metal recovered was to be held subject to control of the shipper of the concentrates.

Only a few small mines and mills were operated in southwestern Missouri in 1932. Most of the lead concentrates were produced by small lessees and sold in small lots. The zinc carbonate sold in 1932 was mainly from the Aurora and Wentworth camps. Two thirds of the sphalerite was shipped by operators in the Waco camp who leased the properties formerly worked by the Missouri-Kansas Zinc Corporation. Small shipments were also made from mines near Granby, Joplin, Oronogo, Fidelity, and Webb City.

The lead ore (3,740,200 tons) mined in the disseminated-lead district in southeastern Missouri yielded 4.36 percent of galena concentrates averaging 72.7 percent lead. As the operators mine and smelt their lead concentrates the assigned value of \$30.01 a ton is more or less arbitrary. Of the 227 tons of galena produced by operators of shallow diggings most was purchased and shipped by T. F. Blount of Potosi. The Annapolis mine and mill in Iron County were idle; the remainder of the galena shipped was produced by the National Lead Co. (St. Louis) and the St. Joseph Lead Co. The five mills of the St. Joseph Lead Co., which have a daily capacity of 17,000 tons, milled about 3,056,000 tons of crude ore—about 75 percent of the quantity treated in 1931. From about March 1 to December 31 the mines were operated at about 50 percent of capacity. The National Lead Co. (St. Louis Smelting & Refining Co.) operated its 3,500-ton mill in 1932 at about 73 percent of its 1931 rate.

Oklahoma.—The average zinc content of sphalerite from Oklahoma increased from 59.9 percent in 1931 to 60.9 percent in 1932. The zinc content of the concentrates made from crude ore averaged 61 percent, and some of the concentrates assayed 63 percent. The zinc content of sphalerite made from old tailings increased from 59.5 percent in 1931 to 60.3 percent in 1932. Many mills were idle in 1932; others were operated part of the year. Very little profit could be made by operators even when high-grade crude ore was treated. Generally the work was distributed among as many employees as possible; in some instances miners were permitted to work upper levels on a restricted weekly output basis, and the output was purchased by the owner of the mine. The wrecking of many old plants and the erection of the largest mill in the district by the Eagle-Picher Mining & Smelting Co. provided an unexpected use of labor and supplies which partly mitigated the idleness in the district. The new mill was put in operation early in the fall of 1932 (although

not run at capacity) on ore mined at v
ported in standard railway cars. A con
made daily are loaded direct on cars for

About 40 mines and tailing mills and
operating at different times during 193
concentrates were made from several idl

About 1,000 tons of the galena and 2
were flotation products. It is estimated
of the concentrates made in 1933 will be

Mine shipments of lead and zinc in Okla

District	Lead concentrates (galena)		Zinc concentr (sphalerite)	
	Short tons	Value	Short tons	Value
Miami.....	13,544	\$405,411	111,830	\$2,07
Peoria.....	48	1,000		
Quapaw and Sunnyside.....	57	1,880	0,440	10
Total, 1931.....	13,649	468,891	118,276	2,17
	17,005	786,719	148,112	3,54

¹ In calculating the metal content of the ores from assays all both lead and zinc. In comparing the values of ore and metal given for the ore is that actually received by the producer, w calculated from the average price for all grades.

Tenor of lead and zinc ore, old tailings, and slime in Oklahoma, 1931

	Crude
Total ore, etc., milled.....	short tons..... 2,2
Total concentrates shipped:	
Galena.....	do..... 12
Sphalerite.....	do.....
Ratio of concentrates to ore, etc.:	
Lead.....	percent.....
Zinc.....	do.....
Metal content of ore, etc.:	
Lead.....	do.....
Zinc.....	do.....
Average lead content of galena concentrates.....	do.....
Average zinc content of sphalerite concentrates.....	do.....
Average value per ton:	
Galena concentrates.....	\$.....
Sphalerite concentrates.....	\$.....

Mine production of lead and zinc concentrates in

District	Lead concentrates (mainly galena)	
	Short tons	Value
Davis.....		
Miami.....	1,037,707	\$90,408,208
Peoria.....	2,254	110,703
Quapaw and Sunnyside.....	25,055	2,239,226
	1,065,016	92,758,197

The larger shippers of concentrates from mines near Commerce were the Lost Trail Mining Co. and the Covert Mining Co. The Quapaw and Sunnyside area had numerous small operators and shippers; its shipments of galena were only 57 tons, and 84 percent of the sphalerite shipped was concentrates made in 1931. Shipments of 1,369 tons of galena and 11,519 tons of sphalerite from the Douthat area were largely those of the Admiralty Zinc Co.; smaller shipments came from the Beck Mining & Milling Co. and the Continental Mining & Development Co., both of which were idle most of 1932. Mines near Hockerville shipped 480 tons of galena and 18,182 tons of sphalerite. Most of the sphalerite was from ore or tailings milled in 1930 or 1931 by the St. Louis Smelting & Refining Co. Other shippers were C. Y. Semple (Brewster tailings), Jager Mining Co., Blue Bonnet Mining Co., Roberts Mining Co., Thurston Mining Co., and Smith Davis Co. The mines and mills in Picher made a much smaller output in 1932 than in 1931, and a large part of the sphalerite sold was from old tailings. The large shippers were the Eagle-Picher Mining & Smelting Co. and its sublessees, the Retriever Milling Co. (tailing mill), Just Right Milling Co. (tailing mill), Midway Mining Co., and Davis Big Chief Mining Co. Mines in the Cardin-Tar River area shipped 8,411 tons of galena and 63,839 tons of sphalerite in 1932, a considerable part of which was concentrates made in 1931. The larger shippers were the Myers Milling Co., Interstate Zinc & Lead Co., and W. H. Aul & Co. from old tailings milled and from mines of the Commerce Mining & Royalty Co. (3 mines), Evans Wallower Lead Co. (2 mines), Velie Mining Corporation, Vinegar Hill Zinc Co., Dines Mining Co., Rialto Mining Corporation, and Eagle-Picher Mining & Smelting Co. (Central and Domado mills).

Wisconsin.—The National Zinc Separating Co. at Cuba City was the only roasting plant operated in Wisconsin in 1932 and treated practically all the zinc concentrates except the high-grade flotation concentrates made by the Badger Zinc Co. Only four mines had an appreciable output. The total value of the concentrates shipped in 1932 was about 60 percent of that in 1931. Very little prospecting was done, and no new mills were built. The larger shipments came from the Badger Zinc Co. at Linden and from the Vinegar Hill Zinc Co. which operated 2 mines at Hazel Green and 1 at Shullsburg.

Mine production of lead and zinc in Wisconsin, 1931-32

Year	Lead concentrates		Zinc concentrates		Metal content ¹			
			Sphalerite		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1931.....	1,307	\$59,277	34,200	\$317,272	952	\$70,448	10,088	\$766,688
1932.....	1,312	38,493	28,133	178,326	910	54,600	7,522	451,320

¹ In calculating the metal content of the ores from assays allowance has been made for roasting and smelting losses of both lead and zinc. In comparing the values of ore and metals it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates

Total ore.....	short tons..	0
Total concentrates in ore:		
Lead.....	percent..	
Zinc.....	do.....	
Metal content of ore:		
Lead.....	do.....	
Zinc.....	do.....	
Average lead content of galena concentrates.....	do.....	
Average zinc content of sphalerite concentrates.....	do.....	
Average zinc content of zinc carbonate concentrates.....	percent..	
Average value per ton:		
Galena concentrates.....		
Sphalerite concentrates.....		
Zinc carbonate concentrates.....		

cutting material patented by McKenna²⁹ combines tungsten and/or molybdenum with the tantalum carbide. The use of tantalum as a binder and otherwise in conjunction with tungsten carbide received further attention in 1932.

A better demand for columbium is predicted in the form of the twin carbides (tantalum-columbium) for use in welding as well as in cutting tools.

Imports.—Imports of tantalum ores into the United States jumped to 36,131 pounds valued at \$51,033 in 1932; this compares with 6,288 pounds in 1931, 8,474 pounds in 1930, and about 15,250 pounds in 1929 (previous record).

World production.—Except for a few small and sporadic shipments the world supply of high-grade tantalite has come from Australia, principally from the Pilbarra field of Western Australia. A Rhodesian concern, however, is reported recently to have offered 5 tons of high-grade ore (72 percent Ta_2O_5) monthly. In the production statistics of British India a small quantity (100 pounds, valued at £4) of columbite was reported as produced in the Monghyr district, Bihar and Orissa, in 1931.

TELLURIUM

During 1932, as in 1931, only two companies reported a production of tellurium, and the Bureau of Mines is not at liberty to publish the amount. In 1930 three producers reported an output of 14,095 pounds and sales of 4,717 pounds valued at \$7,996. The price of the metal is still more or less nominal. Throughout 1932 the quotation was \$2 a pound, f.o.b. New York.

Uses.—Tellurium, even more than its sister element selenium, was long considered a metallurgical abomination. Its presence not only complicated the extraction of valuable metals from their ores, but the metalloid itself exhibited certain highly unpleasant properties. An enormous amount of laboratory time and effort was expended in the search for commercial uses for tellurium but with almost universally disappointing results. In one of the most promising fields, as an antiknock addition to gasoline, it was quickly displaced by tetraethyl lead. Of real importance was the startling discovery by U. C. Tainton that the element is a most valuable reagent for purification of zinc solutions at western electrolytic plants, and almost 90 percent of the domestic output was used for this purpose in 1930.³⁰ The quantity required is about 13 pounds per ton of zinc. In 1932 serious attention was directed to the successful use of tellurium as a rubber-compounding material. It is said to increase resistance of rubber to heat, to be effective in revitalizing old rubber, and to improve aging qualities. The bloom that frequently accompanies the use of selenium is absent when tellurium is employed. Much attention, especially in Europe, has recently been given to the use of tellurium as a lead-hardening agent.

Researches on the use of tellurium in glass making indicate that the color-producing tendencies are like those of selenium, but no commercial applications have yet been made.

²⁹ McKenna, P. M. (assignor to Vanadium Alloys Steel Co.), Composition of Matter (Tungsten-Tantalum Carbide Alloy): U.S. Patent 1848899, Mar. 8, 1932.

³⁰ Chemical and Metallurgical Engineering, Editorial Staff Report on Electrochemical Developments Discussed at Baltimore—Annual Meeting of Electrochemical Society, April 21-23, 1932: Vol. 39, no. 5, May 1932, pp. 276-278.

TITANIUM

The domestic production of titanium is of the order of several hundred tons of or more of ilmenite annually. The actual production was published without revealing individual figures. The Titanium Corporation of America undertook the production of ferrocarbon-titanium. As in former years, the ferro-alloy was made by the McKenna process. The Titanium Pigment Co. (subsidiary of the Titanium Corporation) and the Krebs Pigment & Color Corp. continued to be the leading manufacturers. The former company, after seeking a site on the coast of New Jersey, reported to have selected a site on the coast of New Jersey, near Amboy or Sayreville, N.J.

Prices.—The prices of titanium pigments have remained stationary in 1931 and experienced only slight adjustments in 1932. The pure dioxide remained unchanged at 21 cents (barrels) respectively, a pound. There were two price of titanium-calcium pigment, bright (bags) to 6 cents, compared with 7 cents the year. The new contract price of carbon-titanium (15 to 18 percent titanium) producers' plants, freight allowed, increased, continued throughout 1932.

The price of ilmenite, though nominally per long ton for high-grade imported (dioxide), seaboard, tended to be slightly higher. The quotation at the end of the year (\$11.75 to \$12.70) a metric ton, compared with 1931 and 400 to 425 francs early in the year. The price of domestic rutile, guaranteed concentrate, has not been changed for the price of £45 a ton is mentioned, equivalent to \$72.50.

Metallic titanium was quoted at \$5.00 per pound, 96 to 98 percent quality; the new 96 to 98 percent quality market at \$6, delivered New York.

Uses.—Titanium in the form of carbide is added to the list of superhard cutting materials, said to contain titanium carbide (and molybdenum carbide and the other usual ingredients) material. Another new development is the commercial use of titanium dioxide, under the name of coating material for onion-skin paper. The metal, containing 96 to 98 percent titanium, containing 75 percent product, was placed on the market by Gold-und Silber-Scheideanstalt; it is produced in Germany, from American rutile.

A review of the technical literature indicates interest in titanium additions for various steels, including rail steel, stainless steel, and tool steel.

The new alloys of copper and titanium were studied further, particularly with respect to their marked age-hardening properties and corrosion resistance. Beneficial effects are produced in sundry aluminum-copper alloys by treatment with a fraction of 1 percent of titanium.

New uses reported for titanium salts include their employment in primary electric batteries and in forming a corrosion-resisting coating on steel.

As a constituent of glass titanium dioxide cuts down the selective transparency for short wave lengths. Consequently, according to a recent American abstract of a German patent,³¹ the addition of up to 2 percent titanium dioxide is recommended to inhibit the coloration of certain kinds of glass upon prolonged exposure to sunlight or light of short wave length.

As usual, a variety of new processes and patents are reported in connection with the manufacture of titanium pigments from ilmenite. Mention may be made of a method for making the dioxide from rutile; a finely ground briquetted mixture of magnesia (1 part) and rutile (2 parts) with enough carbon to reduce ferric oxide is heated at 1,410° C., forming the titanate ($MgTiO_3$), which is dissolved in sulphuric acid and subsequently hydrolyzed.³² Titanium chloride is the raw material in another process in which the volatilized salt is oxidized in the flame of a burning gas.³³

Imports.—Imports of ilmenite amounted to 33,491 long tons in 1932 valued at \$231,652 compared with 29,857 tons valued at \$144,951 in 1931 and a previous maximum of 22,386 tons valued at \$104,887 in 1929. The increase in the declared value from \$4.85 per ton in 1931 to \$6.92 in 1932 is noteworthy in view of the sharp drop in the exchange value of the rupee. As in the previous years, imports were all from British India, the dominant source of world supply. The beach deposits of the Travancore State, along the extreme south-westerly shore of the Indian Peninsula, contributed more than 80 percent of the known output of all countries in 1931 and possibly an even larger percentage in 1932. Although British controlled, this output is consumed mainly in the United States.

The imports of rutile jumped to 176,393 pounds valued at \$4,508 compared with 2,000 pounds valued at \$189 in 1931.

REVIEW BY STATES

Arkansas.—The Titanium Corporation of America at Malvern, Hot Springs County, Ark., reported an output of 100 tons of ilmenite and 40 tons of rutile, none of which was shipped due to lack of market. Brookite occurs in this vicinity, which is not far from the deposit at Magnet Cove. According to the trade press,³⁴ another company, the Rock Port Minerals, Inc., Malvern, Ark., was preparing to erect a plant with a daily capacity of 6 tons of titanium concentrates, construction to begin about December 1, 1932.

Virginia.—The new plant of the Southern Mineral Products Corporation, which came into production in 1931, was closed early in 1932; it was subsequently reopened but only for the production of

calcium-acid phosphates (for baking powder). The body of this company contains an average of 1 percent titanium dioxide, which is almost all separated in the form of an ilmenite concentrate. The 1 percent titanium dioxide, which may be separated in another section of the plant or shipped for the manufacture of ferrocarbon-titanium by the American Metal & Thermit Corporation.

In 1932, as in former years, the American Metal & Thermit Corporation (of the Metal & Thermit Corporation) from its properties at Roseland, Nelson County, Va., new tables being installed and better class of concentrates were reported during the several months.

The Bureau of Mines has received numerous reports of rutile from Bedford County, and late in this chapter with Dr. Frank L. Hess, of the Bureau, visited an occurrence of rutile in Nelson County, Va. No deposits of titanium ores of commercial importance, however, have yet been found in this vicinity.

THE INDUSTRY IN FOREIGN COUNTRIES

Australia.—The first factory to produce titanium concentrates in Australia was nearing completion in 1932 at Melbourne and will employ ilmenite deposits on King Island about 130 miles from Melbourne. The beach sands of New South Wales indicate the presence of concentrates consisting mainly of zircon, ilmenite, and rutile, 2 to 8 percent of other minerals.³⁵ These deposits have been worked in the past for gold and platinum, but in 1932 they were reported to be working the sands on the King Island and rutile. Beach Sands Mining Co. is producing 50 tons of concentrates. Black Head Mineral Co. is treating its small experimental output of rutile from the beach sands of South Australia near Yankalilla Gorge.

Canada.—There was no production of titanium concentrates in 1932. Ilmenite, containing in places as much as 10 percent of rutile, occurs in large deposits in the St. Urbain area, about 7 miles north of Baie St. Lawrence, on the shore of the St. Lawrence River about 60 miles from Quebec. Shipments of ilmenite or rutile for export to the United States have been made in several years, amounting to 1,500 short tons in 1931. The genesis of these deposits has been traced who after extensive field work in 1930-31 were formed by replacement in previous times were deposited from solutions derived from a reservoir from which the anorthosite was derived at the time before. An analysis of a deposit of ilmenite and rutile shows Fe 43.62, TiO_2 21.96, P_2O_5 0.12 percent.

³¹ Société Anonyme des Manufactures des Glaces et Produits Chimiques de St. Gobain, Chauny & Creil, Glass: German Patent 543095, Jan. 12, 1927; Chem. Abs., vol. 26, May 10, 1932, p. 2560.

³² Lubowsky, S. J. (Assr. to Metal & Thermit Corporation), Manufacture of Magnesium Titanate: U.S. Patent 1843427, Feb. 2, 1932.

³³ Mittasch, Alwin, Lucas, Richard, and Griessbach, Robert (to I. G. Farbenind. A.-G.), Titanic Oxide: U.S. Patent 1830154, Mar. 22, 1932.

³⁴ Rock Products. Vol. 35, no. 23, Nov. 19, 1932, p. 54.

³⁵ Hunt, Ralph H., American Vice Consul at Melbourne, Australia: World Trade Notes on Chemicals, etc., Bureau of Mines, no. 62, Dec. 26, 1932, p. 6.

³⁶ Whitworth, H. F., Mineralogy and Origin of the Natural Silicates: Jour. Proc. Royal Soc. N. S. Wales, vol. 65, 1931, pp. 1-10.

³⁷ Chemical Engineering and Mining Review: Vol. 24, no. 1, 1932, p. 1.

³⁸ Gillson, Joseph L., Genesis of the Ilmenite Deposits of the Yankalilla Gorge, South Australia: Econ. Geol., vol. 27, no. 6, September 1932, pp. 654-677.

France.—The production of titanium white in France was begun in 1923, and the annual output by two producers is estimated at about 600 tons. Plans are contemplated for expanding output.³⁹

French West Africa.—Black sands occur all along the Senegal coast and southward in French Guinea and (British) Sierra Leone. Commercial exploitation has been confined to the stretch between Rufisque and the mouth of the Gambia, where the sands are rich in ilmenite due to decomposition of the basaltic rocks of Cape Verde and Goree Island, the principal centers being in the vicinity of Joal near the mouth of the Saloum. A good grade of ilmenite (50 percent titanium dioxide) is readily separated from the associated minerals, which include zircon, garnet, magnetite, etc. A maximum of 7,240 metric tons was produced in 1929.

Italy.—According to a recently published review⁴⁰ the production of titanium white in Italy is increasing. Manufacture of this product was undertaken in 1925, and in 1930 the output had risen to 1,400 metric tons. Titanium white is manufactured by one Milanese firm, which treats titanium ore with sulphuric acid.

Russia.—A large paint and varnish factory with a projected output of 12,000 tons was scheduled to be built in 1932 at Cheliabinsk in the Urals.⁴¹ Unofficial reports are to the effect that some 50 million rubles are to be expended in building 13 plants with an aggregate capacity of 150,000 tons of titanium white, lacquers, and mixed paints. Attention was directed to the smelting of Ural titaniferous magnetite, with the recovery of iron, titanium dioxide, and vanadium as joint products. Rock salt is added to the coal before coking, replacing part of the lime in the subsequent blast furnace smelting operation. Slags with 43 percent titanium dioxide were obtained in laboratory furnace, and subsequently⁴² operation on a large scale has been successful.

Sierra Leone.—In the vicinity of York and Hastings, on the coast of Sierra Leone, small quantities of ilmenite, assaying 50 percent or more titanium dioxide, are recovered as a byproduct in mining alluvial platinum.⁴³ In 1931 an output of 10 tons was officially reported.

United Kingdom.—To provide a British source of titanium pigments for the Empire market a new plant was under construction near Luton by National Pigments, Ltd., a subsidiary of the Imperial Smelting Corporation, and Imperial Chemical Industries, Ltd., Goodlass Wall & Lead Industries, Ltd. of England, and the National Lead Co., and Titan Co. of America are reported to be jointly interested in this development. The Imperial Smelting Corporation is also engaged in production of other pigments.

³⁹ Commerce Reports, Expansion of French Paint and Varnish Industry: Bureau of Foreign and Domestic Commerce, no. 17, Apr. 25, 1932, pp. 213-215.

⁴⁰ Chemical Age (London), White Pigments in Italy: Notable Increase in Production of Titanium White: Vol. 27, no. 702, Dec. 10, 1932, p. 554.

⁴¹ Economic Review of the Soviet Union, Paint Factory to be built in Cheliabinsk: Vol. 7, Apr. 1, 1932, p. 107.

⁴² Britzke, E. V., Shmanenko, I. V., and Tagirov, K. Kh., Utilization of Ural Titano-Magnetites Based on the Work of the Institute of Applied Mineralogy: Mineral. Sibir'e, vol. 6, 1931, pp. 629-636; Chem. Abs., vol. 26, July 10, 1932, p. 3462.

⁴³ Mining Journal (London): Vol. 179, no. 8009, Oct. 15, 1932, p. 693.

MINOR METALS

World production of titanium minerals

Mineral and country	1931		
	Ore produced	Content of TiO ₂	Value ¹
	Metric tons	Percent	
Ilmenite:			
Brazil ²	1,389	18-25	\$9,88
Canada (Quebec).....	36,746	54	190,42
India (Travancore).....	8,000	44	47,00
Norway.....	152	50	64
Portugal.....	1,074	47	14,31
Senegal ³	10	(⁴)	(⁴)
Sierra Leone.....	(⁴)	(⁴)	(⁴)
United States.....	(⁴)	(⁴)	(⁴)
Rutile:			
Norway ⁵	21	90-93	6,01
United States.....	(⁴)	(⁴)	(⁴)

¹ Values as officially reported, converted to United States currency as published by the Federal Reserve Board.

² Exports.

³ Data not available.

⁴ Bureau of Mines not at liberty to publish figures.

⁵ Concentrates.

ZIRCONIUM

Production of zirconium minerals in the United States is irregular and almost insignificant, except for small quantities at Pablo Beach, which culminated in 1927. No domestic production has since been reported, although consideration has been given to the production of zirconium as well as ilmenite from black sands in gold fields of California and other Southeastern States.

Zirconium minerals are widely distributed in the United States, but are few, being mostly water-concentrated minerals. Zirconium, usually as zircon, is a joint product of the extraction of such minerals as ilmenite and monazite.

Prices.—The quotations for zirconium pigments are nominal, are modified infrequently and are affected by the downward movement of general commodity prices. Zircon, 55 percent, has remained stationary for some time at \$45 a short ton, f.o.b. seaboard, in 30-35 percent zirconium dioxide. "Zirkite" (natural ZrO₂) the quotation is 65 to 70 percent grade, 65 cents a pound for 65 to 70 percent grade, 70 cents a pound for 70 to 80 percent grade, 80 cents a pound for 80 to 90 percent grade, 90 cents a pound for 90 to 95 percent grade, 95 cents a pound for 95 to 98 percent grade, 1.00 dollar a pound for 98 to 99 percent grade, 1.05 dollar a pound for 99 to 100 percent grade. Zirconium metal of 98 percent purity is quoted at \$7.00 a pound since 1930; in 1932 it was quoted at \$7.00 to quantity.