CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
520-770-3500
http://www.azgs.az.gov
inquiries@azgs.az.gov

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420 S. Norton Ave.,
Los Angeles 5, Calif.
November 17, 1954

Mr. J. D. MacKenzie, Vice President
American Smelting and Refining Co.,
120 Broadway, New York City.

Dear Sir: Slab Zinc Statistics

Following is a revision of report on the above subject made to Mr. McElvenny on February 20, 1947. This carries Slab Zinc statistics through the year 1953. Attached you will find:

1st. Tabulation giving salient statistics for the period 1900-1953 with accompanying key to same.

2nd. Graphic chart with indicated trends in production and consumption of zinc over the present century as well as description of graph.

This study has been made with the idea that past statistics might serve as an indication of the metal's future, particularly as to its sales price.

Since the world's supply of zinc and lead is, in general, derived from the same ores, a brief review of the relative history of the two metals is of interest:

For the period 1900-1943 the E. St. Louis price of zinc averaged 6.18 cents while for the same period the N. Y. price of lead averaged 5.50 cents. For the period 1924-1943 the world's average production of zinc was 1,590,000 tons per year while the average production of lead for the same period was 1,690,000 or slightly higher than zinc.

For the period 1944-1953 the world production of zinc averaged 2,030,000 tons per year, while for the same period the average production of lead showed only a very slight increase at 1,700,000 tons. As a result, while the average price of zinc for the period, largely due to inflation, increased to 12.32 cents, or an increase of 6.14 cents, the price of lead averaged 13.37 cents or an increase of 7.87 cents.

As the ratio of zinc to lead tends to increase in the ores it would appear that it will become more difficult to market zinc at a satisfactory price, particularly in view of the future competition of zinc with the world's rapidly increasing aluminum output.

Referring to the graph it will be noted that for the period 1900-1929 U. S. was an exporter of zinc; for the period 1930-1937

U. S. was self-sufficient; and from 1938 to date imports have rapidly increased, this being explained by decreasing primary domestic production and increasing consumption.

The peak of domestic primary and redistilled secondary production, as indicated on the graph in Orange, was reached in 1941 followed by a slight decline until 1951. Since then the future of the domestic industry looks very uncertain but production, in competition with low cost foreign supplies, will probably continue to decrease.

Domestic consumption as calculated from domestic production of primary, plus redistilled secondary, plus excess of imports and corrected for annual inventories, is indicated by the full Purple line. This does not, however, take into account the slab zinc imports for Government Account, which were approximately as follows:

1950	-	128,256 tons
1951	-	39,949 "
1952	-	40,696 "
1953	-	62,270 "

The dotted Purple line is intended to show trend of consumption after allowing for excess stocks in G.S.A. stockpile.

The domestic trend of a primary production of 520,000 tons in 1960 with an estimated consumption of 1,080,000 tons in 1960 would indicate 1960 import requirements of foreign slab and recoverable zinc in concentrates in the amount of 560,000 tons.

It is rather difficult to indicate the trend of the future world's slab zinc production as this appears to have a very large potential capacity. This is indicated by the rapid recovery of the industry after World War I and the Depression of the Thirties. The great increase in output since World War II is also noteworthy. In the last eight years world production has increased from 1,454,997 tons in 1945 to 2,603,316 tons in 1953.

The production of 2,603,316 tons in 1953 with corresponding U. S. imports of 666,585 tons looks rather disturbing. The origin of these imports is as follows:

	Slab Zinc	Recoverable Zinc As Ore	Total
Canada	108,000 tons	144,000 tons	252,000 tons
Mexico	34,000	141,000	175,000
Europe	78,000	26,000	104,000
Peru	8,000	70,000	78,000
Australia	4,000	9,000	13,000
Others	3,000	42,000	45,000
	235,000 "	432,000 "	667,000 "

Just where the large foreign output is to find a market when the G.S.A. stockpile has reached its limit appears to be a problem. Some possibilities along this line are:

1st. If the European automobile industry expands materially there

will be an important outlet for zinc as die-cast metal. The U. S. 1953 consumption of zinc-base alloys was 305,000 tons of which 60 per cent went into autos. The zinc-base alloys represent nearly 32 per cent of U. S. zinc consumption. In U.K. the 1953 consumption of zinc alloy for die-casting was 27,000 tons or only 10 per cent of total consumption.

2nd. Increased foreign automobile construction will also increase the consumption of zinc oxide in the fabrication of rubber tires. In 1953 the U. S. consumed 20,000 tons of metal for producing French oxide while another 148,000 tons of lead free zinc oxide was produced directly from ore. Most of the latter went into rubber. U. K. 1953 consumption of zinc oxide was 21,000 tons.

3rd. There are possibilities in the increased use of rolled zinc sheets of light weight for roofing, where these have been strengthened by alloying with very small amounts of titanium and copper.

Everything considered, however, the prospects of an improved world price for zinc do not appear to be very bright.

Yours very truly,

/s/ E. P. Fleming

cc RFGoodwin
RDBradford
Simon Strauss
SHLevison
AJPhillips
Lyman Tondel, Jr.
EMcLTittmann
File

(COPY)

SLAB ZINC STATISTICS

Key to Tabulation

General:

Statistics for recent years were obtained from American Bureau of Metal Statistics, while earlier figures were found in old volumes of the Mineral Industry. Early in this century statistics bearing on the zinc industry were very incomplete and in many cases no figures were available. Also for the years 1937 to 1945, inclusive, world war conditions prohibited the publication of full information. In order to obtain the trends during these later years, production figures for Russia, Japan and Manchuria have been estimated. As nearly as possible all figures have been limited to the production and use of zinc as metal. The consumption as oxide, dust, lithopone and sulphate have not been given consideration. All figures are given in short tons of 2,000 lbs.

Column "A"

World production of slab zinc, including that produced from secondary material. For the years 1937-1945, inclusive, production for Russia, Japan and Manchuria has been estimated and added to figures given in A.B.M.S.

Column "B"

U. S. Production of slab zinc derived from domestic ores. Through 1907 slab from secondary material is included in "B".

Column "C"

Slab zinc produced in U. S. by redistillation of secondary material.

Column "D"

Sum of "B" and "C".

Column "E"

U. S. percentage of world production of slab zinc.

Column "F"

1. Imports of zinc into U. S. as ore. Assumed produced as slab.
2. Imports into U. S. as slab.
3. Total imports.

Slab Zinc Statistics - Sheet 2

Column "G"

1. Exports of zinc as ore.

2. Exports of zinc as slab.

3. Exports of manufactured zinc. Sheets, Etc.

4. Total exports.

Column "H"

Stocks of slab on hand Dec. 31st.

Column "I"

U. S. Consumption of Slab Zinc. Obtained by columns D and F total; subtracting Exports of Slab and Manufactured Zinc and correcting for increase or decrease in stocks as shown in Column H. Exports of zinc as ore do not affect Domestic consumption as long as they do not include re-exports of foreign zinc as ore.

Column "J"

Percentage of Domestic consumption relative to World consumption. Column "I" divided by "A".

Column "K"

Foreign consumption. Column "A" minus "I".

Column "L"

Percentage of Foreign consumption relative to World consumption. Column "K" divided by "A".

Column "M"

1. East St. Louis price of zinc.

2. London price (When rate of change was available).

Column "N"

1. Import Tariff on zinc in ores and concentrates.

2. Import Tariff on slab zinc.

SLAB ZINC STATISTICS - SHORT TONS

Compiled by American Smelting and Refining Company, Salt Lake City, Utah

	A	B	C	D	E	F			G				H	I	J	K	L	M		N		
						IMPORTS			EXPORTS									PRICE		TARIFF ON		
YEAR	WORLD PRODUCTION	U. S. PRODUCTION DOM. ORE	U. S. SECOND'Y REDIST'D	U.S. TOTAL DOMESTIC	U. S. PER CENT OF WORLD	IN ORE & CTS.	SLAB	TOTAL	IN ORE & CTS.	SLAB	MAN'D SHEETS,ETC.	TOTAL	U. S. METAL STOCKS DEC.31ST	U. S. CONSUMPTION	U.S. CON. PER CENT OF WORLD	FOREIGN CONSUMPTION	FOREIGN CONSUMPTION P.C. WORLD	EAST ST.LOUIS	LONDON EQUIV.	CTS.	SLAB	YEAR
1900	513,000	123,321	-	123,321	24.1	?	1,007	1,007	42,062	22,411		64,473	-	101,917	19.9	411,083	80.1	4.39¢				1900
01	569,000	140,822	-	140,822	24.8	?	388	388	44,146	3,390		47,536	-	137,820	24.3	431,180	75.7	4.07				01
02	610,000	158,239	-	158,239	26.0	?	619	619	55,733	3,237		58,970	-	155,621	25.5	454,379	74.5	4.84				02
03	638,000	158,502	-	158,502	24.8	?	364	364	39,411	1,521		49,484	-	157,345	24.7	480,655	75.3	5.19				03
04	689,000	181,803	-	181,803	26.4	?	467	467	35,911	10,073		45,984	6,500	165,697	24.1	523,303	75.9	4.93				04
1905	721,000	201,748	-	201,748	28.0	?	521	521	30,946	5,516		36,462	4,000	199,253	27.6	521,747	72.4	5.73	5.50			1905
06	772,000	225,494	-	225,494	29.2	?	2,204	2,204	27,720	4,670		32,390	4,550	222,478	28.9	549,522	71.1	6.05	5.85			06
07	813,000	249,612	-	249,612	30.7	?	1,778	1,778	20,352	563		20,915	32,883	222,494	27.4	590,506	72.6	5.81	5.15			07
08	796,890	190,749	7,159	197,908	24.8	?	881	881	26,108	2,640		28,748	19,613	209,419	26.3	587,471	73.7	4.58	4.38			08
09	854,066	230,225	9,273	239,498	28.0	?	9,670	9,670	12,456	2,566		15,022	11,167	255,048	29.9	599,018	70.1	5.35	4.81	1.00	1.38	09
1910	893,046	252,479	12,784	265,263	29.7	?	3,452	3,452	19,711	6,872		26,583	23,201	249,809	28.0	643,237	72.0	5.37	4.99	1.00	1.38	1910
11	987,812	271,621	14,043	285,664	29.8	15,933	1,638	17,571	29,029	7,330	7,325	43,684	9,323	302,458	30.7	685,354	69.3	5.61	5.48	1.00	1.38	11
12	1,073,017	323,907	26,064	349,997	32.6	17,867	11,115	28,982	30,127	6,682	1,424	38,233	4,474	375,686	35.0	697,331	65.0	6.80	5.72	1.00	1.38	12
13	1,113,872	337,252	25,991	363,243	32.0	13,497	6,099	19,596	23,119	8,403	8,107	39,629	40,659	330,144	29.1	783,728	70.9	5.50	4.92	0.55	0.83	13
14	968,207	343,418	20,545	363,963	37.6	12,132	880	13,012	11,250	70,382	6,842	88,474	19,984	333,378	34.5	634,829	65.5	5.10	4.89	0.51	0.76	14
1915	924,977	458,135	29,764	487,899	53.0	57,669	904	58,573	832	118,995	16,796	136,623	14,221	416,144	45.0	508,833	55.0	13.05		1.30	1.95	1915
16	1,089,882	564,338	28,776	593,114	54.6	148,147	684	148,831	78	193,851	12,755	206,684	17,508	533,055	49.0	556,827	51.0	12.60		1.26	1.90	16
17	1,105,765	584,597	16,835	601,432	54.4	72,474	207	72,681	1,320	201,952	31,493	234,765	53,689	404,487	36.6	701,278	63.4	8.75		0.87	1.31	17
18	914,246	492,405	9,918	502,323	55.0	24,809	35	24,844	62	86,437	36,068	122,567	41,241	417,110	45.7	497,136	54.3	7.85		0.78	1.27	18
19	728,736	452,272	19,748	472,020	64.8	17,009	69	17,078	-	122,002	29,526	151,528	36,793	342,018	47.1	386,718	52.9	7.00		0.70	1.05	19
1920	811,331	450,476	21,371	471,847	58.2	22,487	8,176	30,663	-	102,177	14,534	116,711	71,037	351,555	43.3	459,776	56.7	7.67	7.25	0.77	1.15	1920
21	493,300	198,232	17,573	215,805	43.9	2,705	7,470	10,175	-	3,009	2,456	5,465	70,321	221,231	44.8	272,069	55.2	4.66	4.45	0.47	0.70	21
22	792,566	353,274	32,988	386,262	48.7	1,930	51	1,981	1,695	30,286	14,925	56,906	16,810	386,543	48.8	406,023	51.2	5.72	5.94	1.50	1.75	22
23	1,059,573	508,335	39,900	548,235	51.7	3,426	21	3,447	-	49,211	22,156	71,367	27,808	469,317	44.3	590,256	55.7	6.61	6.74	"	"	23
24	1,124,814	515,831	35,486	551,317	49.0	4,746	25	4,771	-	72,583	16,772	89,355	21,208	473,333	42.0	651,481	58.0	6.34		"	"	24
1925	1,265,714	555,631	39,181	584,812	46.2	13,536	24	13,560	68,951	76,350	22,406	167,707	9,295	511,529	40.4	754,185	59.6	7.62		"	"	1925
26	1,373,212	611,991	40,799	652,790	47.5	14,626	22	14,648	95,249	42,920	16,193	154,362	21,887	595,733	43.3	777,479	56.7	7.34		"	"	26
27	1,464,091	576,960	42,784	619,744	42.4	9,513	59	9,572	46,716	45,695	9,730	102,141	40,751	555,027	37.9	909,064	62.1	6.24		"	"	27
28	1,566,919	591,525	48,666	640,191	40.8	11,000	148	11,148	4,518	35,270	8,481	48,269	45,411	602,928	38.5	963,991	61.5	6.03		"	"	28
29	1,620,898	612,136	47,348	659,484	40.8	14,414	226	14,640	71	14,411	10,095	24,577	75,430	619,599	38.3	1,001,299	61.7	6.51		"	"	29
1930	1,554,742	489,361	34,849	524,210	33.7	25,887	347	26,234	-	4,633	6,247	10,880	143,618	471,376	30.3	1,083,366	69.7	4.56		"	"	1930
31	1,107,948	291,966	21,625	313,291	28.3	779	274	1,053	-	643	5,586	6,229	129,842	321,891	29.1	786,057	71.9	3.64		"	"	31
32	870,758	207,148	14,718	221,866	25.5	1,904	311	2,215	-	6,471	5,329	11,800	124,856	217,367	25.1	653,391	74.9	2.88		"	"	32
33	1,106,864	306,010	30,087	336,097	30.4	2,133	1,941	4,074	-	1,144	6,423	7,567	105,560	351,900	31.8	754,964	69.2	4.03		"	"	33
34	1,305,052	355,366	19,691	375,057	28.7	14,277	1,731	16,008	-	5,105	12,711	17,816	119,830	358,979	27.6	946,073	72.4	4.15		"	"	34
1935	1,487,088	412,184	28,650	440,834	29.5	10,520	4,479	14,999	-	1,617	14,184	15,801	83,758	476,104	32.0	1,010,984	68.0	4.33		"	"	1935
36	1,641,634	491,803	42,209	534,012	32.5	172	11,722	11,899	-	37	15,420	15,457	44,955	569,257	34.7	1,072,377	65.3	4.90		"	"	36
37	1,838,487	551,165	51,554	602,719	32.8	8,811	39,398	48,208	-	249	17,524	17,773	65,333	612,776	33.4	1,225,711	66.6	6.52		"	"	37
38	1,752,330	436,007	31,613	467,820	26.8	18,584	7,486	26,070	-	5,736	13,937	19,673	126,769	412,781	23.6	1,339,549	76.4	4.61		Can.	Can.	38
39	1,849,712	491,058	50,428	541,486	29.2	36,099	31,423	67,522	-	4,515	26,058	30,573	74,262	631,942	34.2	1,217,770	65.8	5.11		"	"	39
1940	1,838,293	589,988	48,917	638,905	34.9	180,320	16,468	196,788	-	79,091	30,287	109,378	17,582	782,995	42.5	1,055,298	57.5	6.34	4.76	"	"	1940
41	1,988,412	652,600	59,503	712,103	35.7	289,213	34,554	323,777	-	89,309	42,625	131,934	24,066	897,462	45.1	1,090,950	54.9	7.47	4.76	"	"	41
42	2,063,325	629,957	53,195	683,152	33.6	368,408	36,352	404,760	-	133,938	29,586	163,524	68,268	880,186	42.7	1,183,139	57.3	8.98	4.76	Mex.	Mex.	42
43	2,019,121	594,250	48,215	642,465	31.8	536,988	56,155	593,143	-	97,439	14,300	111,739	173,510	1,018,627	50.3	1,000,494	49.7	10.54	4.76	0.75	0.875	43
44	1,833,900	574,453	49,037	623,490	34.0	422,700	63,626	486,326	-	21,576	34,053	55,629	237,520	990,177	54.0	843,723	46.1	11.04	4.76	"	"	44
1945	1,454,997	457,084	49,242	516,326	35.4	297,477	97,116	402,346	-	7,779	6,235	14,014	350,069	870,413	58.8	584,584	41.2	8.25		0.75	0.875	1945
46	1,581,751	459,205	44,516	503,721	31.8	269,057	104,743	378,013	-	47,223	13,846	61,069	286,004	884,730	56.0	697.021	44.0	8.726		0.75	0.875	46
47	1,811,346	510,058	59,542	570,600	31.5	292,437	72,312	369,778	-	106,670	7,950	114,620	158,096	953,666	52.7	857,680	47.3	10.500		0.75	0.875	47
48	1,941,783	537,966	62,320	600,286	31.0	249,798	93,232	353,287	-	65,757	6,380	72,137	127,880	911,652	47.9	1,030,131	52.1	13.589	13.48	0.75	0.875	48
49	2,067,930	591,454	55,041	646,495	31.3	223,328	126,925	354,016	-	58,709	7,456	66,165	187,389	874,837	42.3	1,193,093	57.7	12.144		0.75	0.875	49
1950	2,224,780	588,281	66,970	655,261	29.2	255,176	155,974	414,373	-	12,917	4,810	17,727	86,545	1,152,751	51.3	1,072,029	48.7	13.866		0.75	0.875	1950
51	2,335,262	621,826	48,657	670,483	28.7	259,807	88,043	354,662	-	36,510	6,579	43,089	86,603	981,998	42.0	1,353,264	58.0	18.000		0.75	0.875	51
52	2,476,721	575,828	55,111	630,939	25.5	328,651	115,151	447,259	-	57,714	4,231	61,945	185,192	917,664	37.1	1,559,057	62.9	16.215		Suspended for 6 mos.		
53	2,603,316	447,000	51,000	498,000	19.1	425,000	234,574	666,535	-	17,856	4,627	22,483	270,806	1,056,438	40.7	1,546,878	59.3	11.855		0.60	0.70	53
54																						
1955																						
56																						
57																						
58																						
59																						
1960																						

SLAB ZINC STATISTICS

EXPLANATION OF GRAPH

World Production of Slab Zinc

This is plotted as the irregular Carmine line from figures obtained from column A. In general, slab zinc obtained by redistillation of secondary drosses and die-cast is included in these figures.

It will be noted that there was a consistent increase in production from 1900 through 1919, followed by a sharp decline of four years. This was partly due to delay in recovery from World War I, but also due to depletion of clean zinc ore reserves. In 1921 the selective flotation of lead and zinc was perfected, releasing huge tonnages of complex ore. There was a rapid rise in production until 1930 when the metal market crashed. The foreign market improved much more rapidly than the domestic and the stimulus of World War II demand brought out a peak production of 2,063,325 tons in 1942, of which 683,152 tons was of domestic origin and 1,380,175 of foreign.

The sharp decrease in world production to 1,377,420 tons in 1945 can partly be attributed to delayed industrial recovery in Europe and a decline in the E. St. Louis price from the premium supported price in 1944.

Since 1945 there has been a very large increase in the rate of world production, this rising from 1,377,420 tons to 2,603,316 in 1953.

Trend of World Requirements

This is plotted as the straight dotted Carmine line. The intention is to indicate the average trend since 1900 by compensating the depression periods against the recovery periods. This trend indicates that the world will consume an added increment of 30,000 tons of zinc per annum and, under normal conditions, consumption in 1960 should approximate 2,400,000 tons. It will be noted that the 1953 production was 2,600,000 tons.

The 1945 graph indicated that consumption in 1950 should approximate 2,000,000 tons. World production was 2,225,000 tons with 128,000 tons for U. S. Government Account.

Foreign Consumption of Slab Zinc

This is plotted as the irregular Blue line from figures obtained from column K. These figures are arrived at by subtracting U. S. Consumption (Column I) from world production (Column A). The great decrease in foreign consumption can be attributed to the war and delayed recovery from same. The great increase in foreign consumption since then may be misleading, and the true picture can only be obtained when this trend corrects itself.

Trend of Foreign Consumption

This is plotted as the straight dotted Blue line. The intention

is to indicate the average trend since 1900 by compensating the depression periods against the recovery periods. This trend indicates an average increase in foreign consumption of 15,000 tons per annum and under normal conditions foreign consumption in 1960 should approximate 1,340,000 tons.

The 1945 graph indicated that consumption in 1950 should approximate 1,250,000 tons. While the foreign consumption in 1950 was distorted by heavy exports, the average foreign consumption for 1949, 1950 and 1951 was 1,200,000 tons.

Domestic Production of Slab Zinc

This is plotted as the irregular Orange line from figures obtained from Column D, which includes redistilled secondary zinc.

There was a consistent rapid rise in U. S. production until 1917 followed by a rapid decline until 1921. This was partly due to delayed recovery from World War I, and partly due to depletion of clean zinc ore reserves. In 1921 the adoption of selective flotation allowed a rapid rise in production until 1929 when domestic output reached 660,000 tons. Since then there has been a marked decrease in production with the exception of the War period 1940-1944 when the peak production reached 712,000 tons in 1941. Since then, production has been steadily decreasing, partly due to the lower tenor of the lead zinc ores and partly due to increased cost of production.

Trend of Domestic Production

This is plotted as the dotted Orange line. It seems evident that U. S. reached its peak of production in 1941 and from then on we can expect a gradual decline. The indicated trend on graph would show a decrease of 10,000 tons per year, with an expected output of 520,000 tons in 1960.

The 1945 graph indicated that domestic production in 1950 would be 570,000 tons. Production in 1950 was 630,000, probably stimulated by a rising price to 13.87 cents per pound.

Domestic Consumption of Slab Zinc

This is plotted as the irregular Purple line from figures obtained from Column I.

In general, there was a consistent increase in consumption from 1900 to 1929, followed by the depression of the early thirties. From 1932 there was a rapid recovery up to 1943, with the exception of a short relapse in 1938. Since 1943 there has been a consistent rise in consumption but the rate has been clouded by G.S.A. buying and the extent to which this went into the strategic stockpile.

Trend of Domestic Consumption

This is plotted as the straight dotted Purple line.

Indications are that domestic consumption is increasing at the rate of 16,000 tons per year and by 1960 consumption should be approximately 1,080,000 tons.

The 1945 graph indicated that U. S. consumption should reach 820,000 tons in 1950. Consumption in 1950, according to the Bureau of Mines, was abnormally high at 967,000 tons. As noted above, the uncertainty of the figures is indicated by the Bureau of Mines consumption figures for the following years:

1947	1948	1949	1950	1951	1952	1953
786,400	817,700	711,800	967,100	934,000	852,000	977,000

Domestic Imports of Zinc

This is plotted as the Green line, figures being obtained from Column F.

It will be noted that, with the exception of World War I period 1915-1917 inclusive, the U. S. imports of zinc were practically negligible until 1937. Since then we have become a consistent importer, imports reaching peaks of 593,143 tons in 1943 and 667,000 tons in 1953. It is probable that by 1960 excess imports over exports will be somewhere around 550,000 tons per year.

Domestic Exports of Zinc

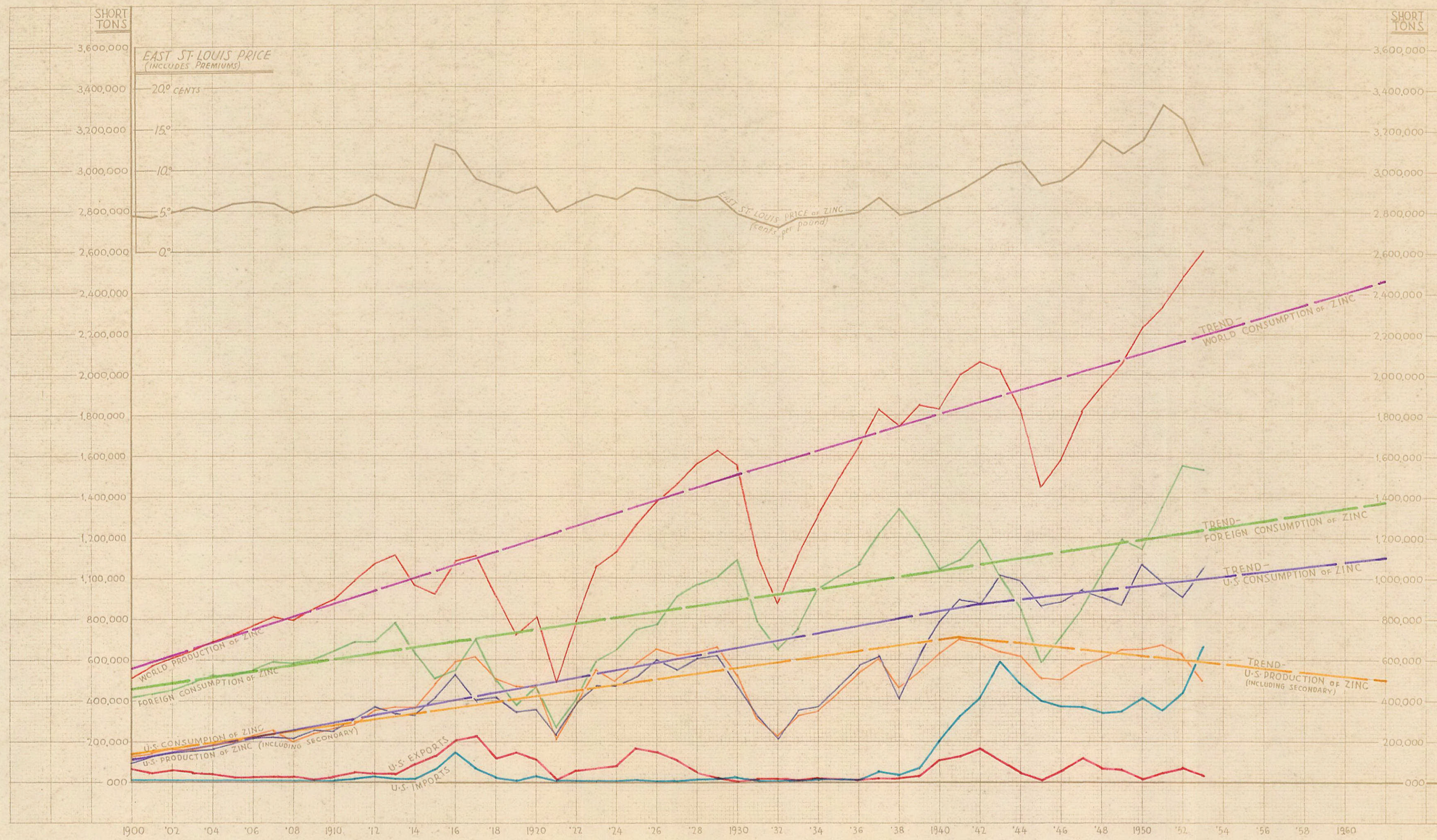
This is plotted as the Red line, figures being obtained from Column G.

It will be noted that up to 1929 the U. S. was a consistent exporter of zinc. From 1929 to 1936 exports balanced imports. Since 1936 exports, while materially less than imports, showed a large increase due to shipment of war supplies, reaching a total of 163,524 tons in 1942. Since then exports have been practically negligible.

East St. Louis Price of Zinc (Including Premiums)

This is plotted as the heavy Black line and is obtained from Column M.

Over the past 53 years the St. Louis price has varied from a low of 2.88¢ average in 1932 to an average high of 18.00¢ in 1951. The average price over the whole period is 7.20¢.



SLAB ZINC STATISTICS

COMPILED BY

AMERICAN SMELTING & REFINING CO.

SALT LAKE CITY - UTAH

4-801a

MR. ~~[illegible]~~

READ AND RETURN .....

PREPARE ANSWERS ..... HANDLE .....

FILE ✓ ..... INITIALS .....

AUG 3 1965

New York, June 7, 1965

J. H. C.

L.P.E.

JUN 8 1965

JUN 9 - 1965

M.E.S.

JUL 7 1965

MEMORANDUM FOR: Mr. E. McL. Tittmann

Statistical Zinc Study - Southwestern United States and Mexico

In accordance with your recent request and my letter of May 6th to Mr. Courtright, there is attached for your information copy of Mr. Courtright's letter of June 4th with Mr. Bowditch's report dated June 3rd covering his statistical study of mine zinc production in the Southwest, including Mexico.

This summary report with the attached production graphs, charts and tabulations is quite complete. I am sure you will agree it presents the situation concisely and clearly. Mr. Bowditch's conclusions and projections are interesting and will be useful for future reference.

The graph of Mexican production shows a steady increase in zinc production with only minor changes reflected by the zinc price. This is in contrast to the Southwestern states where production fluctuations are indicated by price changes. Although Mr. Bowditch concludes that future price increases will result in progressively smaller mine production from the Southwest due to depletion of reserves, this, as Mr. Courtright points out, may be off set somewhat through byproduct zinc from open pit operations of the tactite deposits similar to Mission. Table V shows a possible additional tonnage of 55,000 tons per year from this source.

Mr. Courtright also notes that two of Asarco's former large producers, Santa Eulalia and Parral, are nearing exhaustion. He, nevertheless, notes that the outlook in general for Mexico is favorable since substantial reserves exist in mines which presently account for 90% of Mexican production.

C. P. Pollock

Enc.

CC-TASnedden
RFWelch
JHCourtright
SIBowditch

~~+3-19.13C (26)~~
Au - 0.0.26B

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 7, 1965

TO: J. H. Courtright

FROM: S. I. Bonditch

Zinc Study
Southwest United States

Since finishing my report on statistical zinc studies I realize that I omitted to mention two mines which tend to invalidate my statement that intensive exploration has failed to uncover any important zinc deposits. My failure to think of them may be because each is more important as a lead-silver deposit, and yet each may eventually contribute substantial quantities of zinc. The two deposits are the Fed Shaft (Ruby Hill) orebody at Eureka, Nevada, and the Burgin mine of Kennecott in the East Tintic District, Dividend, Utah.

We have no recent figures on ore reserves for either mine, but in the case of the Fed Shaft (Ruby Hill body) a report by Ira Jerulaum in 1949 gives 600,000 tons of ore that runs 0.192 Au, 11.52 Ag, 3.7 Pb and 9 Zn. Other estimates run over 1,000,000 tons of slightly lower grade. In its isolated location, 90 miles from the nearest railroad, it is doubtful if it will pay to make and ship a zinc concentrate.

The Burgin mine covers several ore bodies, and grade varies drastically between bodies, but may average around 8% Zn, according to published figures. There has been talk that production might be around 300 tons per day. If this tonnage and grade are correct, an annual production of 12,000 tons of zinc metal, or 24,000 tons of concentrate, would result. Reserves of over 1,000,000 tons of ore are probable.

S. I. Bonditch

SIB:cmc
cc: G. P. Pollock (2)
T. A. Snodden
E. B. Moen
R. F. Welch

EK 7/28/65

Circulate to all geologists
RGB

NPW 6/22/65

JOB 7/29/65

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 4, 1965

L.P.E. J.R.W.

JUN 21 1965 JUN 7 1965

Mr. C. P. Pollock, Vice President
American Smelting and Refining Company
120 Broadway
New York, N. Y. 10005

T.C.O.

AUG 3 1965

ZINC STUDY
SOUTHWEST UNITED STATES AND MEXICO

Dear Sir:

This transmits Mr. Bowditch's report on the past and future of zinc in the Southwest, tributary to Amarillo, Texas.

Mr. Bowditch concludes that his price-production graphs for the Southwest indicate that the future price increases will bring out progressively smaller increases in production. But, this trend may be offset considerably by new sources of zinc in the form of a by-product from large tactite deposits operated as open-pit copper mines, such as Mission and Pima. Possible additional sources of zinc may reach a total of 55,000 tpy during the next ten years.

In Mexico, production has been less affected by price, and the over-all trend has been steadily upward. However, one large producer in the past, Santa Eulalia is now essentially mined out. The East Camp or San Antonio has substantial reserves, but also a serious water problem. Parral is another large producer which is nearing the end. In general, the outlook is favorable, since substantial reserves exist in mines which presently account for probably 90% of Mexican zinc production.

Yours very truly,

Original signed by
J. H. Courtright

J. H. COURTRIGHT

JHC/jak
Encl.
cc: CPPollock, 1 extra, w/encl.
TASnodden, w/encl.
RBHuen, w/encl.
RFWelch, w/encl.
SIBowditch, w/o encl.

Ar-1.0.26B

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 3, 1965

To: J. H. Courtright

From: S. I. Bowditch

Zinc Statistical Study
Southwest United States

Introduction

In accordance with Mr. Pollock's request of May 6, I have made a statistical study of zinc production from the Southwestern states of Arizona, Colorado, New Mexico, Nevada and Utah, and from Mexico, since World War I. Figures for production were taken from the yearly volumes of "Minerals Yearbook" (originally "Mineral Resources"), published by the United States Bureau of Mines, and average prices from the Engineering and Mining Journal. The results of this compilation are given in a series of tables and graphs which are attached to this report.

In the case of both the United States and Mexico, figures are given as contained or "recoverable" metal, not as concentrates. To translate metal figures into concentrate, a multiplication by 2 would be a good first approximation. Southwestern zinc concentrates contain 50% to 60% total zinc, but the U.S.B.M. figures are for "recoverable" metal. This term is not defined, but is probably between 85% to 90% of total, so the factor of 2 I suggest for converting metal to concentrates is probably as close as it is necessary to come.

Conclusions

Mr. Pollock asked particularly if there was any trend evident, especially in relation to price. With minor exceptions, Mexico shows a steady rise in production which reflects only briefly changes in price. This probably is caused, at least in part, by the inability of the mines to close down without government permission, and the consequent cost of severance pay.

In the case of the Southwest, production has reflected changes in price, but more faithfully in declining production with a fall in price than the reverse. From the point of view of the Amarillo plant, it should be noted that the peak production was in the late forties and early fifties. This in turn reflects Arizona's peak, and most of the mines responsible for this production are now exhausted. On the whole, I would expect an increase in the price of zinc to bring out a progressively smaller increase in production from the area as time goes on. Only the discovery of a completely new district, (or new mines in old districts) will change this picture.

However, the recent installation of a zinc circuit at Mission offers the possibility that other porphyry copper mines which have appreciable limy sediments included in the ore zone may also produce zinc. Among these

are Pima and Anaconda's Twin Buttes mine. Table V shows production from these and other sources that might be expected, in addition to present production, if the price of zinc continues at its present level, and the operators decide that zinc production is possible and economic. The possible eventual net addition of 55,000 tons of metal is impressive.

History

Accompanying this report is a table (TableI) showing the production of recoverable zinc from each of the five states discussed from 1920 to 1964, as well as their combined production. From this table I have constructed two graphs (Figures 1 and 2). Figure 1 is a bar graph showing production by states and for the region as a whole, with the yearly average price shown in its proper relation above. Figure 2 is a line graph which shows more clearly the annual fluctuation in each state.

These graphs clearly show the sharp drop in price following World War I and the practically complete suspension in zinc production in 1921. Prices improved slowly up to 1925, and held steady until 1929. During this period production increased each year until 1925, and then held steady following the price curve. The main production came from Utah, New Mexico, and Colorado; Nevada production was small and Arizona negligible.

The onset of the Great Depression in 1930 caused a precipitous drop in production, and by 1932 only New Mexico and Utah were active. In Utah, where the zinc accompanies lead in the ores, the zinc concentrates were stockpiled, waiting for a better price. New Mexican production came chiefly from the Pecos mine.

Prices recovered a little in 1933, and held steady until 1939, with a short lived rise in 1937 which is reflected faithfully in the total production. However, this results chiefly from increased output in Utah; 1937 was the depression low point for New Mexico, partly because of a strike at the Pecos mine. The Central District of New Mexico (Silver City--Santa Rita area) became important during this period, and after Pecos closed in 1939 because of exhaustion of ore reserves, Central became the principal zinc mining area in New Mexico.

With the outbreak of World War II in 1939 a steady rise in price began which continued with only one small drop (1949) until 1952. During the war ceiling prices were in effect, but were also greatly modified by the Premium Price Plan. Production rose even more steeply during the early years, and in New Mexico, Colorado and Utah, peaked in 1943, and then fell off as the manpower shortage became acute. The Premium Price Plan ceased in 1947, but the rise in price offset this. Response to conditions after the war was varied from state to state. With the exception of Arizona, each state hit a low between 1945 and 1947, and then recovered. Arizona merely hesitated in its steep upward climb. At that time, in Arizona, Bisbee was far in the lead, followed by San Xavier, Johnson Camp, Mammoth-St. Anthony, and others.

Arizona peaked in 1949, and then, as Bisbee's reserves became exhausted, dropped off rapidly, even though the Korean War forced price to a record high of 18 cents in 1951. Nevada began its slide to extinction in 1951. Utah also was unable to take full advantage of the Korean high, and dropped off during this period. Only Colorado and New Mexico reflect this price peak.

The drop in price from 1951 to 1953 is faithfully reflected in production, even to an exaggerated extent. Every state experienced sharp drops, and in New Mexico all major mines were closed by October 1953, not to reopen until 1955. Nevada practically closed down. In Colorado, Kokomo had closed, and Resurrection ceased production. All the small Colorado producers also closed. In Arizona, San Xavier, the Magma Copper-Zinc area, and Mammoth-St. Anthony all closed, primarily because the ore reserves were nearly exhausted, but also because the mines could not operate under the lower price.

The upturn in price from 1953 to 1956 also caused an increase in production in all states, but the reversal in price in 1957 caused further shutdowns. Combined Metals in Pioche finally gave up the ghost after a hard struggle, and Nevada is now to all intents and purposes out of the picture. New Mexico production fell almost to nothing by 1959. In Colorado the ASARCO--Resurrection Joint Venture was shut down, and for the first time since the discovery of the camp there was no production of any kind from Leadville.

From 1957 until last year the price of zinc was fairly steady, with only one short rise (and then fall) in 1960. This sharp little price peak is not reflected in the production.

The recent rise in price has brought on renewed activity, especially in New Mexico, where ASARCO has reopened Ground Hog. Colorado production has been rising since 1960. This increase has been chiefly due to the reopening of the Keystone mine, enlargement of the Camp Bird mill (now down, but due to be reopened by Federal Resources) and the Standard Metals operation of the Sunnyside mine and Shenandoah mill. In Arizona, Iron King is the only important producer, and increased prices are not offsetting rising costs.

A comparison of possible interest is the relation of the Southwestern production to total United States production. Table II and Figure 3 show this. After World War I, Southwestern production dropped from about 7% to less than 1%, and then rose to over 22% by 1931. High mining costs compared to the Tri-State, caused the Southwestern percentage to drop to 15% by 1935, and it remained at this level until after World War II began. The lack of reserves in the Tri-State prevented this area from responding to the war demand as could the Southwest, and the Southwestern production rose to 35% of the total by 1949. About this time the Appalachian zinc field became of importance, and with the price-cost squeeze of the early fifties the Southwestern share dropped to 20%. The price increase in 1957 raised the figure to 30%, but again the price-cost pincer dropped the Southwest share to 22% by 1963. In 1964 the figure increased to 24%. This comparison illustrates how much more sensitive to price are the high cost Southwestern producers than the lower cost eastern zinc mines.

I am not sufficiently familiar with Mexico to make an analysis of that country, but for what it may be worth, Table III and Figure 4 show total Mexican production as reported by the U.S. Bureau of Mines. In general, production has increased from practically nothing in 1921 to around 275,000 tons now. This increase has been remarkably regular. The big depression low, a low at the beginning of World War II, when the usual European markets were cut off and the United States had not taken up the slack, and another in 1946, due to a strike, are the major breaks in an otherwise remarkably steady rise. As said earlier, in some respects this is due to the difficulty of shutting down a money-losing operation, so production continued even when the companies were suffering losses.

The Future

Other factors beside price enter into any forcast of future production. Chief among these are the actual exhaustion of mines, and even districts, that once were major producers, and, on the other hand, the development, or prospect of development of new mines.

While in 1949 Arizona led the five states under review, with production from Bisbee, Iron King, San Xavier, Mammoth-St. Anthony, Johnson Camp and Trench-Flux, now the Iron King is the only major producer in the state, and this mine is expected to reach its economic limit in the next two or three years. Colorado has had a fairly even production, but Kokomo is finished, and Gilman has no more than about ten years expected life. In Nevada, Pioche, the only important district, dropped off rapidly after 1950, and was closed completely by 1958. New Mexico has had tremendous fluctuations and shows most clearly a dependence on price. Utah, like Colorado, has been reasonably steady, but its two principal producers, Bingham--Lark and Park City, are nearing the end of their history as major producers. Present exploration of the lower limestones at Park City may bring about a revival, but it is too early to say yet.

In spite of considerable exploration over the last twenty years, no important new zinc deposits, or even extensions of old ones, have been found in the area. The only completely new mine known to me is the Continental Materials Mine in the Twin Buttes district in Arizona. This is a copper-zinc limestone replacement mine with a reported reserve of 1,200,000 tons of 7% zinc, 1.5% copper, and some silver and lead. A production of 500 tons of ore per day is planned. The owners are inexperienced and the operation may turn out to be unsuccessful. The ASARCO--Resurrection Joint Venture at Leadville is an almost new property, with a known reserve of 700,000 tons of 7.0% zinc along with some lead and silver. More ore must be developed to justify a mill, but I believe the chances of doing so are excellent. However, this will take several years.

A possible new source of zinc is a by-product from several of the so-called porphyry coppers which obtain a major portion of their ore from sediments. Mission already has a zinc circuit in its new by-product plant. The Imperial area of Silver Bell contains around 1% zinc in the sulphide portion, but unfortunately it is too intimately mixed with the copper to be economically recovered. It seems likely that Anaconda's new deposit at Twin Buttes, which is geologically similar to Mission, also contains appreciable zinc, and it is known that Pima has some zinc. Likewise, the tactites now being developed at Chino (Santa Rita) should carry some zinc as should the copper orebody near Hanover, New Mexico, being developed by U.S. Smelting Company. However, I have been informed that Chino does not contain sufficient zinc to consider its recovery. If all these deposits could recover zinc, the amount of recoverable metal should be important.

Of the new sources mentioned, Continental may produce 11,000 tons of contained zinc a year, ASARCO--Resurrection 16,000 tons, and Mission between 9,000 and 20,000 tons yearly, depending on the grade being mined. The grade is supposed to improve as mining continues west, but distribution of value is very irregular. Anaconda's Twin Buttes project might produce a like amount. Pima has some zinc in the arkose and more in the deeper lying hornfels, but has made no real study of the occurrence or possibility of economic recovery. A possible production similar to Mission can be guesstimated.

Table V has been prepared to reflect the ideas expressed above, and shows possible additional production which may come out in the next ten years, over and above that shown in the 1964 figures. This should be considered as only an informed guess, and is based in part on the anticipation that Anaconda and Pima will eventually recover zinc from their copper ores in the Twin Buttes district. The table also points up the probably loss of Iron King in the next two or three years. The potential is impressive (55,000 tons of zinc or 110,000 tons of concentrate by 1971), but too much depends on decisions yet to be made to consider that there is a real firmness in the figures.

To sum up, I would expect that an increase in price would be less and less reflected by an increase in production from the established producers, but to offset this there is the possibility of production from Continental, ASARCO--Resurrection Joint Venture, Pima and Twin Buttes.

Acknowledgements

In the preparation of this report I have benefitted from the advice and suggestions of Messers L. P. Entwistle, R. K. Kirkpatrick, Reed Welch, and J. H. Courtright, but they are not responsible for the ideas and conclusions expressed herein.

S. I. Bowditch

S. I. Bowditch

SIB:cme
cc: C. P. Pollock (3)

Attachments:

Table I	Zinc Production--Southwest--1920-1964
Table II	Proportion of Southwest Zinc Production to Total U.S. Production
Table III	Zinc Production--Mexico--1920-1964
Table IV	Annual Average Metal Prices
Table V	Possible Additional Sources of Zinc in Next 10 Years
Figure 1	Bar Graph of State and Southwestern Zinc Production, and Annual Average Price
Figure 2	Line Graph of State Zinc Production
Figure 3	Graph Showing Southwest Production as Precent of Total U.S.
Figure 4	Graph of Mexican Zinc Production

TABLE I
Zinc Production - Southwest
1920 - 1964
Recoverable Zinc - Short tons

Year	Ariz.	Colorado	Nevada	New Mex.	Utah	Total
1920	729	24,395	5,349	5,007	4,079	39,559
1921	--	1,180	35	114	35	1,364
1922	105	11,629	1,309	2,248	2,560	17,851
1923	260	27,076	7,083	8,248	5,665	48,332
1924	--	28,364	5,501	10,380	9,281	53,526
1925	3,666	30,811	7,411	9,246	26,306	77,440
1926	6,473	32,500	5,409	12,052	47,590	104,024
1927	1,134	35,865	3,172	29,802	49,593	119,566
1928	639	35,731	3,398	31,203	46,929	117,900
1929	1,229	29,431	8,460	34,455	51,510	125,085
1930	815	36,259	14,584	32,765	44,495	128,918
1931	--	16,187	10,431	27,866	37,291	91,775
1932	--	109	127	25,593	29,666	55,495
1933	6	1,285	6,387	30,924	29,745	68,347
1934	905	772	13,940	26,522	28,198	70,337
1935	3,337	1,202	15,536	22,126	31,307	73,508
1936	3,589	1,172	13,477	20,668	36,192	75,098
1937	5,026	4,247	14,236	23,927	48,001	95,437
1938	5,814	4,553	8,944	28,236	33,658	81,205
1939	6,711	1,830	6,228	29,356	34,526	78,651
1940	15,456	5,060	11,833	30,313	43,788	106,450
1941	16,493	15,722	15,129	37,862	42,049	127,255
1942	18,522	32,215	10,197	46,461	45,543	152,938
1943	19,677	44,094	13,647	59,524	46,896	183,801
1944	29,077	39,955	20,699	50,727	38,994	179,452
1945	40,226	35,773	21,457	40,295	33,630	171,381
1946	43,665	36,147	22,649	36,103	28,292	166,856
1947	54,644	38,745	16,970	44,103	43,673	198,135
1948	54,478	45,164	20,288	41,502	41,490	202,922
1949	70,658	47,703	20,443	29,346	40,670	208,820
1950	60,480	45,776	21,606	29,263	31,678	188,803
1951	52,999	55,714	17,443	45,419	34,317	205,892
1952	47,143	53,203	15,357	50,975	32,947	199,625
1953	27,530	37,809	5,812	13,373	29,184	113,708
1954	21,461	35,150	1,035	6	34,031	91,683
1955	22,684	35,350	2,670	15,277	43,556	119,537
1956	25,580	40,246	7,488	35,010	42,374	150,698
1957	33,905	47,000	5,292	32,680	40,846	159,230
1958	28,532	37,132	91	9,034	44,982	119,771
1959	37,325	35,388	217	4,636	35,223	112,789
1960	35,811	31,278	420	13,770	35,476	116,755
1961	29,585	42,647	453	22,900	37,239	132,914
1962	32,888	43,351	281	22,015	34,313	132,848
1963	25,419	48,109	571	12,938	36,179	123,216
1964*	25,450	51,530	270	29,600	32,000	138,850

*Preliminary

TABLE II
Relation of Zinc Production in
Southwest to Total U. S. Production
Short Ton "Recoverable" Zinc

	S. West States	Total U. S.	% Total - SW
1920	39,559	586,384	6.75
1921	1,364	256,746	.53
1922	17,851	472,032	3.86
1923	48,332	610,690	7.90
1924	53,526	637,977	8.39
1925	77,440	710,847	10.86
1926	104,024	774,563	13.43
1927	119,566	718,541	16.63
1928	117,900	695,170	16.96
1929	125,085	724,478	17.27
1930	128,918	595,425	21.65
1931	91,775	410,318	22.37
1932	55,495	285,002	19.47
1933	68,347	384,280	17.79
1934	70,337	438,726	16.03
1935	73,508	517,903	14.19
1936	75,098	575,574	13.05
1937	95,437	626,362	15.24
1938	81,205	516,703	15.72
1939	78,651	583,807	13.47
1940	106,450	665,068	16.01
1941	127,255	749,125	16.99
1942	152,938	768,025	19.91
1943	183,801	744,196	24.70
1944	179,452	718,642	24.97
1945	171,381	614,358	27.90
1946	166,856	574,833	29.03
1947	198,135	637,608	31.07
1948	202,922	629,977	32.21
1949	208,820	593,203	35.20
1950	188,803	623,375	30.29
1951	205,892	681,189	30.23
1952	199,625	666,001	29.97
1953	113,708	547,430	20.77
1954	91,683	473,471	19.36
1955	119,537	514,671	23.23
1956	150,698	542,340	27.79
1957	159,230	531,735	29.95
1958	119,771	412,005	29.07
1959	112,789	425,303	26.52
1960	116,755	435,427	26.81
1961	132,914	464,390	28.62
1962	132,848	505,491	26.28
1963	123,216	529,254	23.28
1964*	138,850	574,000	24.19

*Estimate

TABLE IV

E&MJ Annual Average Metal Prices—1899 to 1964

Year	COPPER (a) Domestic Refinery	COPPER Foreign Refinery	LEAD Common N. Y.	ZINC PW (b) E. St. Louis	TIN (c) N. Y.	SILVER (e) N. Y.	MERCURY (f) N. Y.	ALUMINUM Ingot
1899	16.67	.....	4.470	5.750	25.12	59.580	43.63	32.72
1900	16.19	.....	4.370	4.390	29.90	61.330	51.00	32.72
1901	16.11	.....	4.330	4.070	16.74	58.950	47.00	33.00
1902	11.026	.....	4.069	4.840	26.79	52.160	48.03	33.00
1903	13.235	.....	4.237	5.191	28.09	53.570	41.32	33.00
1904	12.823	.....	4.309	4.931	27.99	57.221	41.00	35.00
1905	15.590	.....	4.707	5.730	31.358	60.352	38.50	35.00
1906	19.278	.....	5.657	6.048	39.819	66.791	40.90	35.75
1907	20.004	.....	5.325	5.812	38.166	65.237	41.50	45.00
1908	13.208	.....	4.200	4.578	29.465	52.864	44.84	28.70
1909	12.982	.....	4.273	5.352	29.725	51.502	46.30	22.00
1910	12.738	.....	4.446	5.370	34.123	53.486	47.06	22.25
1911	12.376	.....	4.420	5.608	42.281	53.304	46.54	30.07
1912	16.341	.....	4.471	6.799	46.096	60.835	42.46	22.01
1913	15.269	.....	4.370	5.504	44.252	59.791	39.54	23.64
1914	13.602	.....	3.862	5.061	34.301 (d)	54.811	48.31	18.63
1915	17.275	.....	4.673	13.054	38.590	49.684	87.01	33.98
1916	27.202	.....	6.858	12.634	43.480	65.661	125.49	60.71
1917	27.180	.....	8.787	8.813	61.802	81.417	106.30	51.59
1918	24.628	.....	7.413	7.890	88.750	96.772	123.47	33.53
1919	18.691	.....	5.759	6.988	63.328	111.122	92.15	32.14
1920	17.456	.....	7.957	7.671	48.273	100.900	81.12	32.72
1921	12.502	.....	4.545	4.655	29.916	62.654	45.46	21.11
1922	13.382	.....	5.734	5.716	32.554	67.528	58.95	18.68
1923	14.421	.....	7.267	6.607	42.664	64.873	66.50	25.41
1924	13.024	.....	8.097	6.344	50.176	66.781	69.76	27.03
1925	14.042	.....	9.020	7.622	57.893	69.065	83.13	27.19
1926	13.795	.....	8.417	7.337	65.285	62.107	91.90	26.99
1927	12.920	.....	6.755	6.242	64.353	56.370	118.16	25.40
1928	14.570	.....	6.305	6.027	50.427	58.176	123.51	24.300
1929	18.107	.....	6.833	6.512	45.155	52.993	122.15	24.300
1930	12.982	.....	5.517	4.556	31.694	38.154	115.01	23.787
1931	8.116	.....	4.243	3.640	24.467	28.700	87.35	23.300
1932	5.555	.....	3.180	2.876	22.017	27.892	57.93	23.300
1933	7.025	6.713	3.869	4.029	39.110	34.727	59.23	23.300
1934	8.428	7.271	3.866	4.158	52.191	47.973	73.87	23.300
1935	8.649	7.538	4.065	4.328	50.420	64.273	71.99	20.000
1936	9.474	9.230	4.710	4.901	46.441	45.087	79.92	20.000
1937	13.167	13.018	6.009	6.519	54.337	44.883	90.18	19.917
1938	10.000	9.695	4.739	4.610	42.301	43.225	75.47	30.000
1939	10.965	10.727	5.053	5.110	50.323	39.082	103.94	10.000
1940	11.296	10.770	5.179	6.335	49.827	34.773	176.86	18.691
1941	11.797	10.901	5.793	7.474	52.018	34.783	185.02	16.500
1942	11.775	11.684	6.481	8.250	52.000	38.333	196.35	15.000
1943	11.775	11.700	6.500	8.250	52.000	44.750	195.21	15.000
1944	11.775	11.700	6.500	8.250	52.000	44.750	118.36	15.000
1945	11.775	11.700	6.500	8.250	52.000	51.928	134.89	15.000
1946	13.820	14.791	8.109	8.726	54.544	80.151	98.24	15.000
1947	20.958	21.624	14.673	10.500	77.949	71.820	83.74	15.000
1948	22.038	22.348	18.043	13.589	99.250	74.361	76.49	15.733
1949	19.202	19.421	15.364	12.144	99.336	71.930	79.46	17.000
1950	21.235	21.549	13.296	13.866	95.539	74.169	81.26	17.713
1951	24.200	26.258	17.500	18.000	127.077	89.368	210.13	19.000
1952	24.200	31.746	16.467	16.215	120.473	84.941	199.097	19.410
1953	28.798	30.845	13.489	10.855	95.845	85.188	193.032	20.931
1954	29.694	29.889	14.054	10.681	91.838	85.250	264.386	21.784
1955	37.491	39.115	15.138	12.299	94.735	89.099	290.348	23.668
1956	41.818	40.434	16.013	13.494	101.409	90.826	259.923	24.032 (g)
1957	29.576	27.157	14.658	11.399	96.261	90.820	246.978	25.416
1958	25.764	24.123	12.109	10.309	95.127	89.044	229.057	24.790
1959	31.182	28.892	12.211	11.448	102.053	91.202	227.484	24.738
1960	32.053	29.894	11.948	12.946	101.438	91.375	210.760	26.000
1961	29.921	27.919	10.871	11.542	113.311	92.449	197.605	25.458
1962	30.600	28.514	9.631	11.625	114.652	108.521	191.208	23.875
1963	30.600	28.413	11.137	11.997	116.652	127.912	189.451	22.623
1964	31.960	30.985	13.596	13.568	157.595	129.300	314.787	23.741

(a) Lake copper 1897–98: domestic market since 1932. (b) New York delivery 1898–1902. (c) 99% in 1897 to 1920, inclusive: Straits quality thereafter. (d) Average for 11 months. (e) New York market. . . . All quotations in cents per lb, except for silver, which is in cents per troy oz, and (f) mercury, which is in dollars per flask of 76 lb. See opposite page and reverse for weekly average prices for 1964. (g) Unalloyed ingot beginning 1956.

TABLE III
Zinc Production in Mexico
(From U.S.B.M.)

	Metric Tons	Short Tons
1920	?	
1921	1,257	1,386
1922	6,342	6,991
1923	18,481	20,768
1924	24,659	27,182
1925	51,795	57,094
1926	105,367	116,146
1927	137,724	151,813
1928	161,747	178,294
1929	174,050	191,855
1930	124,106	136,802
1931	120,307	132,614
1932	57,000	62,831
1933	89,339	98,478
1934	125,000	136,685
1935	136,000	149,913
1936	150,250	165,620
1937	154,625	170,443
1938	172,000	189,596
1939	134,000	147,708
1940	109,000	120,151
1941	154,966	170,819
1942	189,278	208,541
1943	197,199	217,372
1944	219,309	241,744
1945	209,940	231,417
1946	139,535	153,809
1947	195,814	215,845
1948	179,029	197,344
1949	178,402	196,652
1950	223,530	246,397
1951	180,064	198,485
1952	227,375	250,638
1953	226,541	249,715
1954	223,571	246,441
1955	269,403	296,961
1956	248,891	274,351
1957	243,030	267,891
1958	224,108	247,033
1959	263,939	290,938
1960	262,429	289,274
1961	268,977	296,492
1962	250,687	276,330
1963	241,100	265,763
1964	Not Available	

TABLE V

Possible Additional Sources of Zinc in Next 10 Years

Ton Recoverable Zinc

Source	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Mission	9,000	9,000	9,000	9,000	9,000	10,000	10,000	10,000	10,000	10,000
Continental	----	5,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
ASARCO--Res.	----	----	----	12,000	16,000	16,000	16,000	16,000	16,000	16,000
Ground Hog	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Twin Buttes	----	----	----	----	5,000	10,000	10,000	10,000	10,000	10,000
Pima	----	----	----	----	3,000	5,000	8,000	8,000	8,000	8,000
Iron King	----	----	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)
Total	24,000	29,000	20,000	32,000	44,000	52,000	55,000	55,000	55,000	55,000

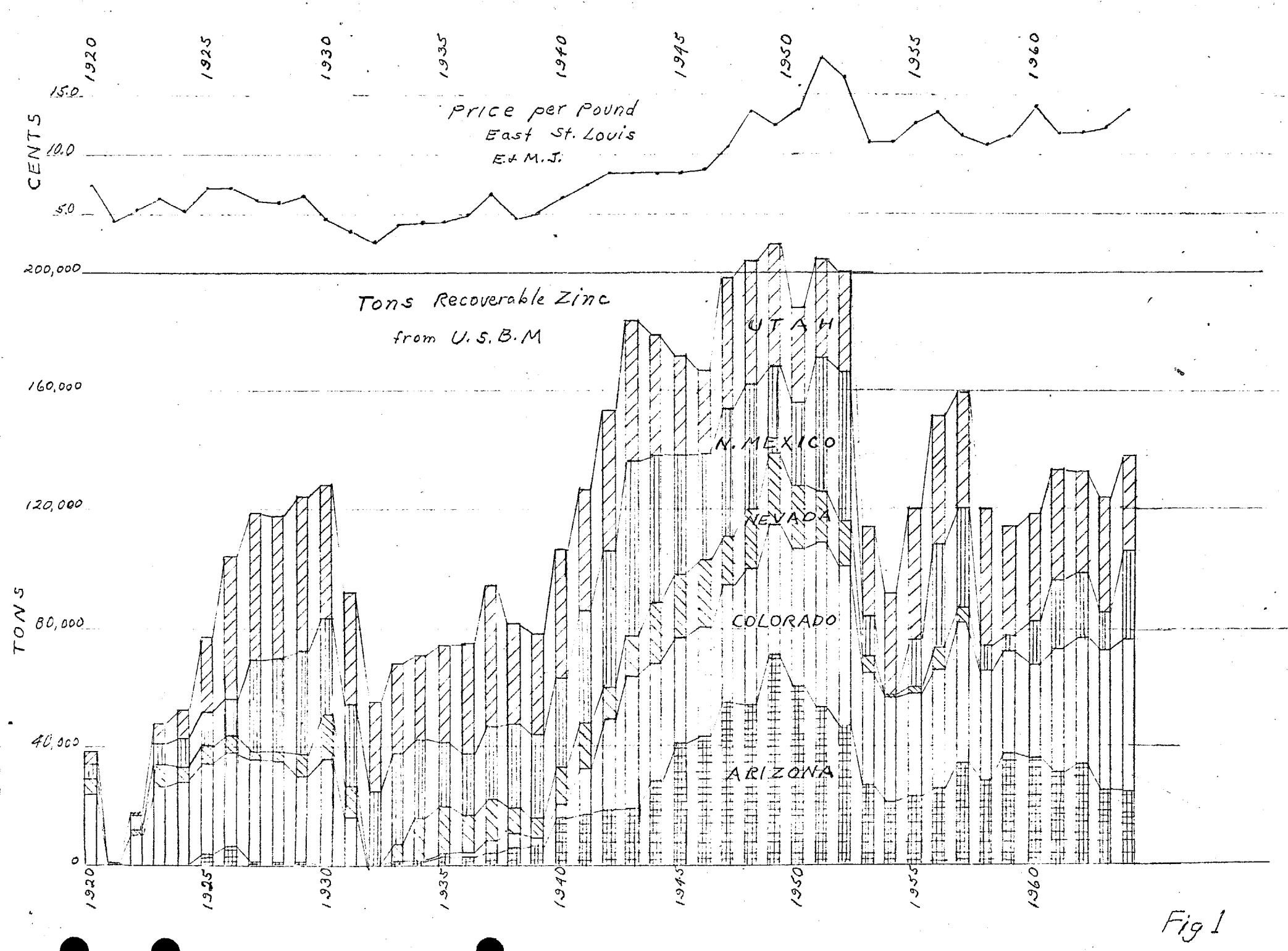

1920
1925
1930
1935
1940
1945
1950
1955
1960
15.0
10.0
5.0
CENTS
Price per Pound
East St. Louis
E. & M. J.
200,000
160,000
120,000
80,000
40,000
0
TONS
Tons Recoverable Zinc
from U.S.B.M
UTAH
N. MEXICO
NEVADA
COLORADO
ARIZONA

Fig 1

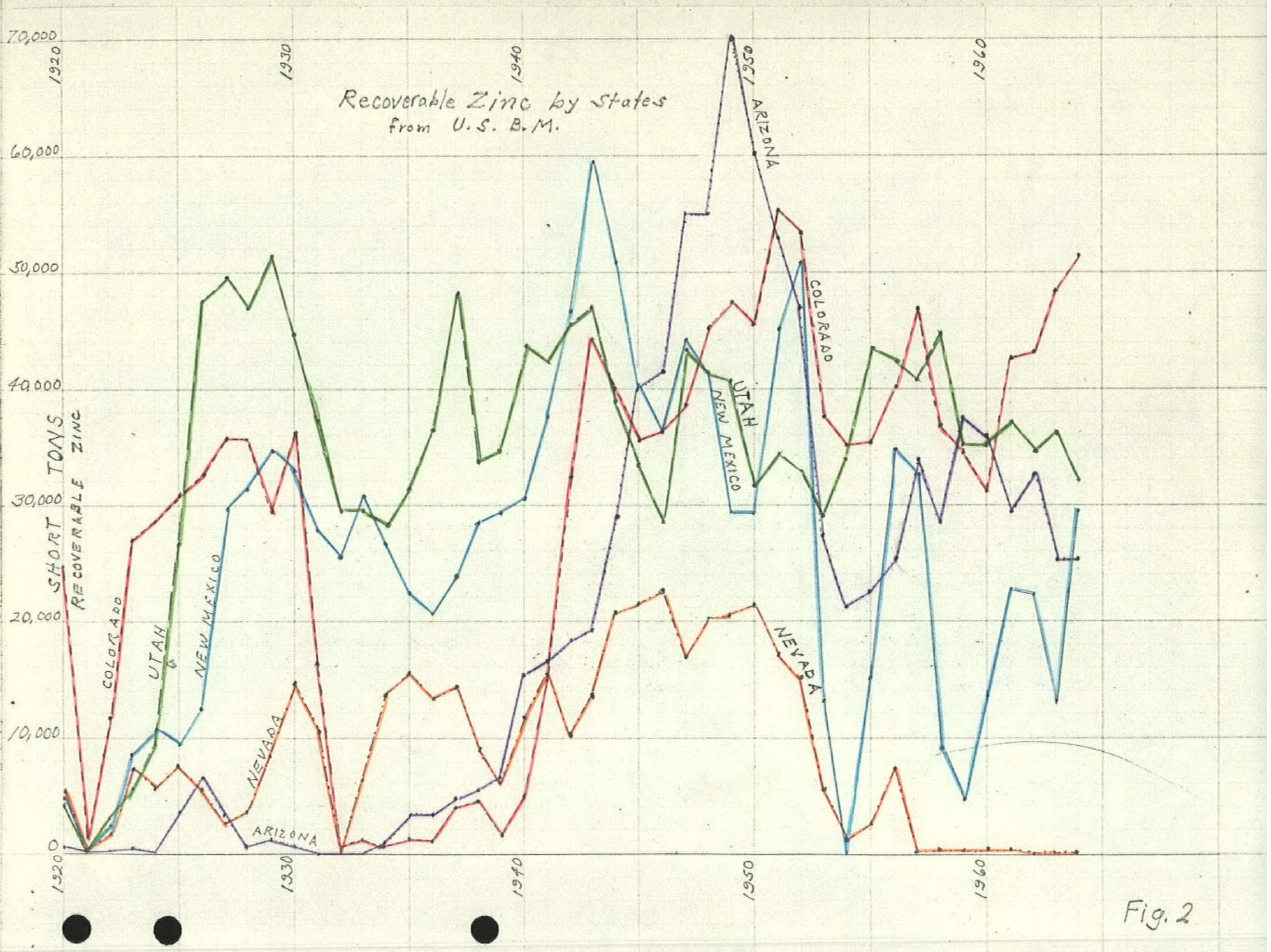

Recoverable Zinc by States
from U.S. B.M.
SHORT TONS
RECOVERABLE ZINC
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1920
1930
1940
1950
1960
ARIZONA
COLORADO
UTAH
NEW MEXICO
NEVADA

Fig. 2

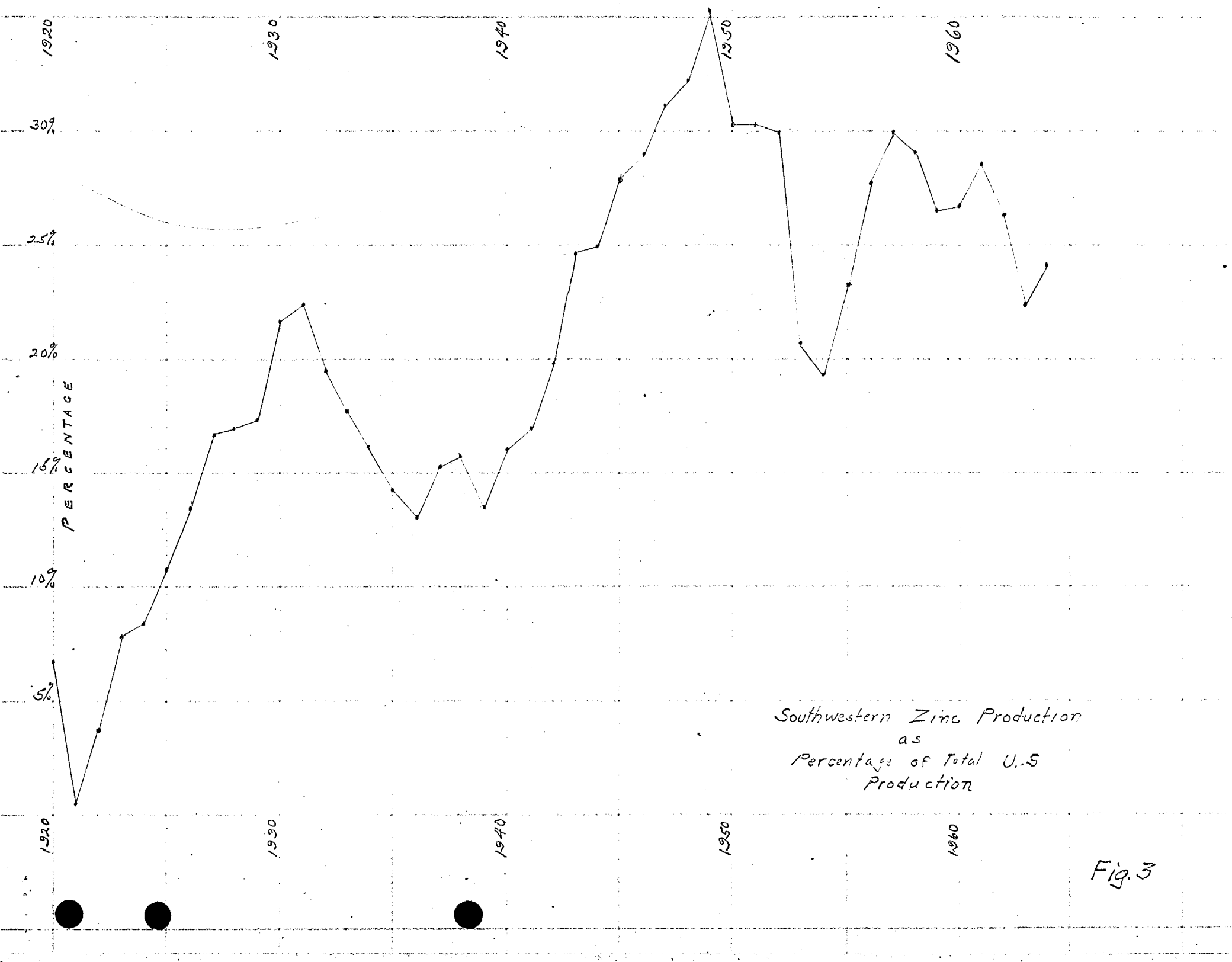

1920
1930
1940
1950
1960
30%
25%
20%
15%
10%
5%
PERCENTAGE
Southwestern Zinc Production
as
Percentage of Total U.S
Production

Fig. 3

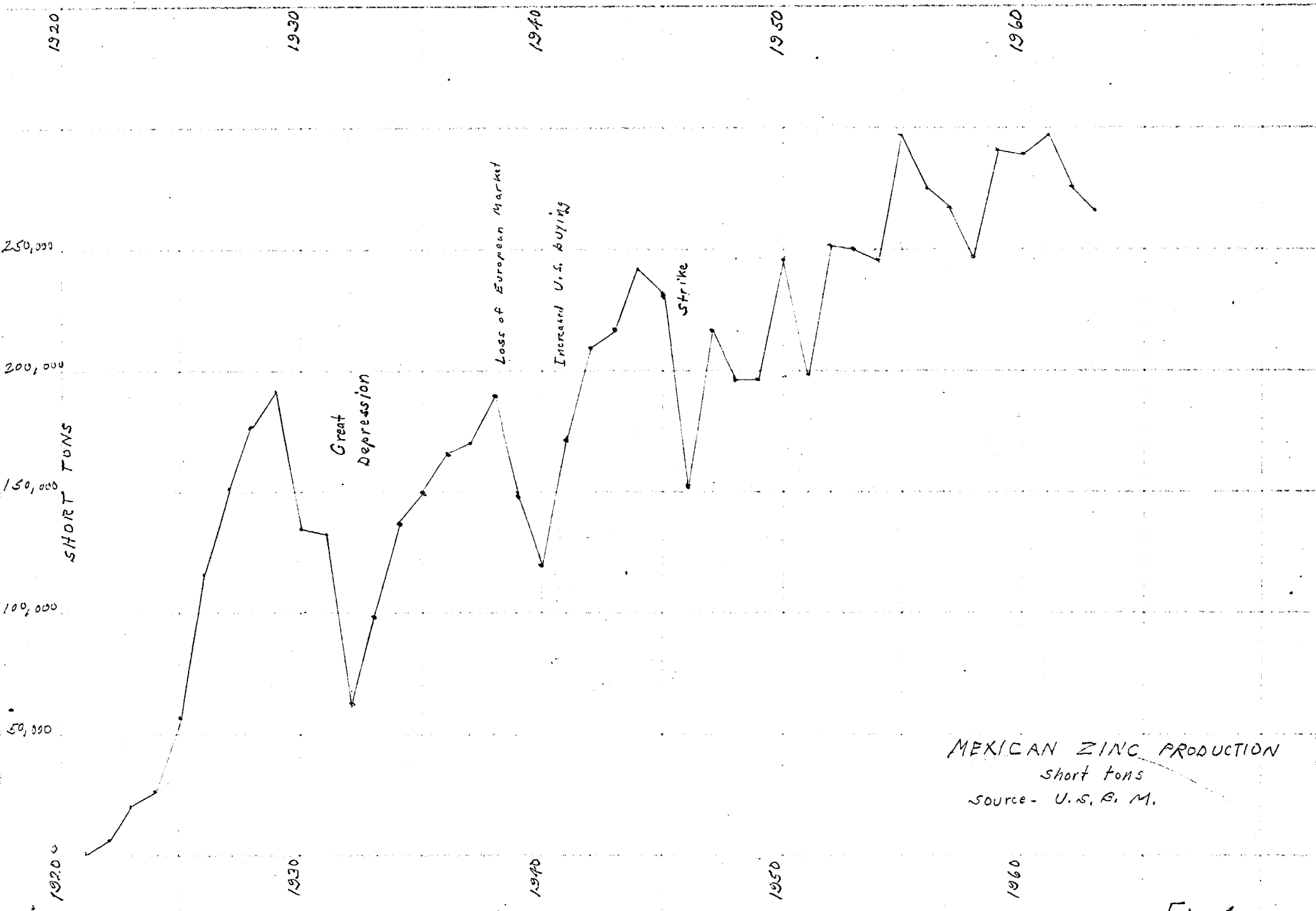

1920
1930
1940
1950
1960
250,000
200,000
150,000
100,000
50,000
SHORT TONS
Great Depression
Loss of European Market
Increased U.S. Buying
Strike
MEXICAN ZINC PRODUCTION
short tons
source - U.S.B.M.

Fig. 4

Judy: Please copy for WES and SID 5/10/65
J.H.C.

MAY 10 1965

AMERICAN SMELTING AND REFINING COMPANY
EXPLORATION DEPARTMENT
120 BROADWAY, NEW YORK 5, N.Y.

C. P. POLLOCK
VICE PRESIDENT

Air Mail

May 6, 1965

Mr. J. H. Courtright
American Smelting & Refining Company
Box 5795
Tucson, Arizona

Zinc Statistical Study - Southwest United States

Dear Mr. Courtright:

In accordance with our telephone conversation today, will you please arrange for Mr. Bowditch to make a statistical study of zinc concentrates production in the Southwest, tributary to the Amarillo, Texas plant. This would include Arizona, New Mexico, Colorado, Utah and Mexico.

We would like to determine, if possible, whether there may be a trend in mine production from the area since World War I. In case a trend is indicated, Mr. Bowditch could then project probable zinc concentrates production to 1970 and 1975 on the basis of these statistical studies.

Undoubtedly, factors other than the price of zinc enters into the pattern of production. For example, improved metallurgy in the period since World War I has made many marginal or submarginal deposits of the Southwest, economic. Likewise the discovery of important deposits and new districts as well as depletion of reserves in principal producing areas has influenced production trends. Possibly, import duties and quotas have played an important role in the rate of mine production from the Southwest.

Forecasting probable zinc concentrates production from any area, obviously, is an involved problem and is particularly hazardous if price is taken into account. Although price is an important factor and if a trend can be observed in the ratio of mine production and price, the study might be quite helpful in forecasting probable future concentrate supply from the area.

In general, it is reasonable to expect a decline in production from vein type mines in the Southwest where mass-production methods cannot be adopted. Since no major replacement occurrences of the Tennessee or metalline type deposits are known in the Southwest and with the Tri-State Mines exhausted, the outlook for increased production admittedly is not promising unless we can expect a substantial and sustained increase in the price of zinc.

CC-EMcLTittmann

Yours very truly,

C. P. Pollock

C. P. Pollock

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 3, 1965

To: J. H. Courtright

From: S. I. Bowditch

Zinc Statistical Study
Southwest United States

Introduction

In accordance with Mr. Pollock's request of May 6, I have made a statistical study of zinc production from the Southwestern states of Arizona, Colorado, New Mexico, Nevada and Utah, and from Mexico, since World War I. Figures for production were taken from the yearly volumes of "Minerals Yearbook" (originally "Mineral Resources"), published by the United States Bureau of Mines, and average prices from the Engineering and Mining Journal. The results of this compilation are given in a series of tables and graphs which are attached to this report.

In the case of both the United States and Mexico, figures are given as contained or "recoverable" metal, not as concentrates. To translate metal figures into concentrate, a multiplication by 2 would be a good first approximation. Southwestern zinc concentrates contain 50% to 60% total zinc, but the U.S.B.M. figures are for "recoverable" metal. This term is not defined, but is probably between 85% to 90% of total, so the factor of 2 I suggest for converting metal to concentrates is probably as close as it is necessary to come.

Conclusions

Mr. Pollock asked particularly if there was any trend evident, especially in relation to price. With minor exceptions, Mexico shows a steady rise in production which reflects only briefly changes in price. This probably is caused, at least in part, by the inability of the mines to close down without government permission, and the consequent cost of severance pay.

In the case of the Southwest, production has reflected changes in price, but more faithfully in declining production with a fall in price than the reverse. From the point of view of the Amarillo plant, it should be noted that the peak production was in the late forties and early fifties. This in turn reflects Arizona's peak, and most of the mines responsible for this production are now exhausted. On the whole, I would expect an increase in the price of zinc to bring out a progressively smaller increase in production from the area as time goes on. Only the discovery of a completely new district, (or new mines in old districts) will change this picture.

However, the recent installation of a zinc circuit at Mission offers the possibility that other porphyry copper mines which have appreciable limy sediments included in the ore zone may also produce zinc. Among these

are Pima and Anaconda's Twin Buttes mine. Table V shows production from these and other sources that might be expected, in addition to present production, if the price of zinc continues at its present level, and the operators decide that zinc production is possible and economic. The possible eventual net addition of 55,000 tons of metal is impressive.

History

Accompanying this report is a table (TableI) showing the production of recoverable zinc from each of the five states discussed from 1920 to 1964, as well as their combined production. From this table I have constructed two graphs (Figures 1 and 2). Figure 1 is a bar graph showing production by states and for the region as a whole, with the yearly average price shown in its proper relation above. Figure 2 is a line graph which shows more clearly the annual fluctuation in each state.

These graphs clearly show the sharp drop in price following World War I and the practically complete suspension in zinc production in 1921. Prices improved slowly up to 1925, and held steady until 1929. During this period production increased each year until 1925, and then held steady following the price curve. The main production came from Utah, New Mexico, and Colorado; Nevada production was small and Arizona negligible.

The onset of the Great Depression in 1930 caused a precipitous drop in production, and by 1932 only New Mexico and Utah were active. In Utah, where the zinc accompanies lead in the ores, the zinc concentrates were stockpiled, waiting for a better price. New Mexican production came chiefly from the Pecos mine.

Prices recovered a little in 1933, and held steady until 1939, with a short lived rise in 1937 which is reflected faithfully in the total production. However, this results chiefly from increased output in Utah; 1937 was the depression low point for New Mexico, partly because of a strike at the Pecos mine. The Central District of New Mexico (Silver City--Santa Rita area) became important during this period, and after Pecos closed in 1939 because of exhaustion of ore reserves, Central became the principal zinc mining area in New Mexico.

With the outbreak of World War II in 1939 a steady rise in price began which continued with only one small drop (1949) until 1952. During the war ceiling prices were in effect, but were also greatly modified by the Premium Price Plan. Production rose even more steeply during the early years, and in New Mexico, Colorado and Utah, peaked in 1943, and then fell off as the manpower shortage became acute. The Premium Price Plan ceased in 1947, but the rise in price offset this. Response to conditions after the war was varied from state to state. With the exception of Arizona, each state hit a low between 1945 and 1947, and then recovered. Arizona merely hesitated in its steep upward climb. At that time, in Arizona, Bisbee was far in the lead, followed by San Xavier, Johnson Camp, Mammoth-St. Anthony, and others.

Arizona peaked in 1949, and then, as Bisbee's reserves became exhausted, dropped off rapidly, even though the Korean War forced price to a record high of 18 cents in 1951. Nevada began its slide to extinction in 1951. Utah also was unable to take full advantage of the Korean high, and dropped off during this period. Only Colorado and New Mexico reflect this price peak.

The drop in price from 1951 to 1953 is faithfully reflected in production, even to an exaggerated extent. Every state experienced sharp drops, and in New Mexico all major mines were closed by October 1953, not to reopen until 1955. Nevada practically closed down. In Colorado, Kokomo had closed, and Resurrection ceased production. All the small Colorado producers also closed. In Arizona, San Xavier, the Magma Copper-Zinc area, and Mammoth-St. Anthony all closed, primarily because the ore reserves were nearly exhausted, but also because the mines could not operate under the lower price.

The upturn in price from 1953 to 1956 also caused an increase in production in all states, but the reversal in price in 1957 caused further shutdowns. Combined Metals in Pioche finally gave up the ghost after a hard struggle, and Nevada is now to all intents and purposes out of the picture. New Mexico production fell almost to nothing by 1959. In Colorado the ASARCO--Resurrection Joint Venture was shut down, and for the first time since the discovery of the camp there was no production of any kind from Leadville.

From 1957 until last year the price of zinc was fairly steady, with only one short rise (and then fall) in 1960. This sharp little price peak is not reflected in the production.

The recent rise in price has brought on renewed activity, especially in New Mexico, where ASARCO has reopened Ground Hog. Colorado production has been rising since 1960. This increase has been chiefly due to the reopening of the Keystone mine, enlargement of the Camp Bird mill (now down, but due to be reopened by Federal Resources) and the Standard Metals operation of the Sunnyside mine and Shenandoah mill. In Arizona, Iron King is the only important producer, and increased prices are not offsetting rising costs.

A comparison of possible interest is the relation of the Southwestern production to total United States production. Table II and Figure 3 show this. After World War I, Southwestern production dropped from about 7% to less than 1%, and then rose to over 22% by 1931. High mining costs compared to the Tri-State, caused the Southwestern percentage to drop to 15% by 1935, and it remained at this level until after World War II began. The lack of reserves in the Tri-State prevented this area from responding to the war demand as could the Southwest, and the Southwestern production rose to 35% of the total by 1949. About this time the Appalachian zinc field became of importance, and with the price-cost squeeze of the early fifties the Southwestern share dropped to 20%. The price increase in 1957 raised the figure to 30%, but again the price-cost pincer dropped the Southwest share to 22% by 1963. In 1964 the figure increased to 24%. This comparison illustrates how much more sensitive to price are the high cost Southwestern producers than the lower cost eastern zinc mines.

I am not sufficiently familiar with Mexico to make an analysis of that country, but for what it may be worth, Table III and Figure 4 show total Mexican production as reported by the U.S. Bureau of Mines. In general, production has increased from practically nothing in 1921 to around 275,000 tons now. This increase has been remarkably regular. The big depression low, a low at the beginning of World War II, when the usual European markets were cut off and the United States had not taken up the slack, and another in 1946, due to a strike, are the major breaks in an otherwise remarkably steady rise. As said earlier, in some respects this is due to the difficulty of shutting down a money-losing operation, so production continued even when the companies were suffering losses.

The Future

Other factors beside price enter into any forcast of future production. Chief among these are the actual exhaustion of mines, and even districts, that once were major producers, and, on the other hand, the development, or prospect of development of new mines.

While in 1949 Arizona led the five states under review, with production from Bisbee, Iron King, San Xavier, Mammoth-St. Anthony, Johnson Camp and Trench-Flux, now the Iron King is the only major producer in the state, and this mine is expected to reach its economic limit in the next two or three years. Colorado has had a fairly even production, but Kokomo is finished, and Gilman has no more than about ten years expected life. In Nevada, Pioche, the only important district, dropped off rapidly after 1950, and was closed completely by 1958. New Mexico has had tremendous fluctuations and shows most clearly a dependence on price. Utah, like Colorado, has been reasonably steady, but its two principal producers, Bingham--Lark and Park City, are nearing the end of their history as major producers. Present exploration of the lower limestones at Park City may bring about a revival, but it is too early to say yet.

In spite of considerable exploration over the last twenty years, no important new zinc deposits, or even extensions of old ones, have been found in the area. The only completely new mine known to me is the Continental Materials Mine in the Twin Buttes district in Arizona. This is a copper-zinc limestone replacement mine with a reported reserve of 1,200,000 tons of 7% zinc, 1.5% copper, and some silver and lead. A production of 500 tons of ore per day is planned. The owners are inexperienced and the operation may turn out to be unsuccessful. The ASARCO--Resurrection Joint Venture at Leadville is an almost new property, with a known reserve of 700,000 tons of 7.0% zinc along with some lead and silver. More ore must be developed to justify a mill, but I believe the chances of doing so are excellent. However, this will take several years.

A possible new source of zinc is a by-product from several of the so-called porphyry coppers which obtain a major portion of their ore from sediments. Mission already has a zinc circuit in its new by-product plant. The Imperial area of Silver Bell contains around 1% zinc in the sulphide portion, but unfortunately it is too intimately mixed with the copper to be economically recovered. It seems likely that Anaconda's new deposit at Twin Buttes, which is geologically similar to Mission, also contains appreciable zinc, and it is known that Pima has some zinc. Likewise, the tactites now being developed at Chino (Santa Rita) should carry some zinc as should the copper orebody near Hanover, New Mexico, being developed by U.S. Smelting Company. However, I have been informed that Chino does not contain sufficient zinc to consider its recovery. If all these deposits could recover zinc, the amount of recoverable metal should be important.

Of the new sources mentioned, Continental may produce 11,000 tons of contained zinc a year, ASARCO--Resurrection 16,000 tons, and Mission between 9,000 and 20,000 tons yearly, depending on the grade being mined. The grade is supposed to improve as mining continues west, but distribution of value is very irregular. Anaconda's Twin Buttes project might produce a like amount. Pima has some zinc in the arkose and more in the deeper lying hornfels, but has made no real study of the occurrence or possibility of economic recovery. A possible production similar to Mission can be guesstimated.

Table V has been prepared to reflect the ideas expressed above, and shows possible additional production which may come out in the next ten years, over and above that shown in the 1964 figures. This should be considered as only an informed guess, and is based in part on the anticipation that Anaconda and Pima will eventually recover zinc from their copper ores in the Twin Buttes district. The table also points up the probably loss of Iron King in the next two or three years. The potential is impressive (55,000 tons of zinc or 110,000 tons of concentrate by 1971), but too much depends on decisions yet to be made to consider that there is a real firmness in the figures.

To sum up, I would expect that an increase in price would be less and less reflected by an increase in production from the established producers, but to offset this there is the possibility of production from Continental, ASARCO--Resurrection Joint Venture, Pima and Twin Buttes.

Acknowledgements

In the preparation of this report I have benefitted from the advice and suggestions of Messers L. P. Entwistle, R. K. Kirkpatrick, Reed Welch, and J. H. Courtright, but they are not responsible for the ideas and conclusions expressed herein.

S. I. Bowditch

S. I. Bowditch

SIB:cme
cc: C. P. Pollock (3)

Attachments:

Table I	Zinc Production--Southwest--1920-1964
Table II	Proportion of Southwest Zinc Production to Total U.S. Production
Table III	Zinc Production--Mexico--1920-1964
Table IV	Annual Average Metal Prices
Table V	Possible Additional Sources of Zinc in Next 10 Years
Figure 1	Bar Graph of State and Southwestern Zinc Production, and Annual Average Price
Figure 2	Line Graph of State Zinc Production
Figure 3	Graph Showing Southwest Production as Precent of Total U.S.
Figure 4	Graph of Mexican Zinc Production

TABLE I
Zinc Production - Southwest
1920 - 1964
Recoverable Zinc - Short tons

Year	Ariz.	Colorado	Nevada	New Mex.	Utah	Total
1920	729	24,395	5,349	5,007	4,079	39,559
1921	--	1,180	35	114	35	1,364
1922	105	11,629	1,309	2,248	2,560	17,851
1923	260	27,076	7,083	8,248	5,665	48,332
1924	--	28,364	5,501	10,380	9,281	53,526
1925	3,666	30,811	7,411	9,246	26,306	77,440
1926	6,473	32,500	5,409	12,052	47,590	104,024
1927	1,134	35,865	3,172	29,802	49,593	119,566
1928	639	35,731	3,398	31,203	46,929	117,900
1929	1,229	29,431	8,460	34,455	51,510	125,085
1930	815	36,259	14,584	32,765	44,495	128,918
1931	--	16,187	10,431	27,866	37,291	91,775
1932	--	109	127	25,593	29,666	55,495
1933	6	1,285	6,387	30,924	29,745	68,347
1934	905	772	13,940	26,522	28,198	70,337
1935	3,337	1,202	15,536	22,126	31,307	73,508
1936	3,589	1,172	13,477	20,668	36,192	75,098
1937	5,026	4,247	14,236	23,927	48,001	95,437
1938	5,814	4,553	8,944	28,236	33,658	81,205
1939	6,711	1,830	6,228	29,356	34,526	78,651
1940	15,456	5,060	11,833	30,313	43,788	106,450
1941	16,493	15,722	15,129	37,862	42,049	127,255
1942	18,522	32,215	10,197	46,461	45,543	152,938
1943	19,677	44,094	13,647	59,524	46,896	183,801
1944	29,077	39,955	20,699	50,727	38,994	179,452
1945	40,226	35,773	21,457	40,295	33,630	171,381
1946	43,665	36,147	22,649	36,103	28,292	166,856
1947	54,644	38,745	16,970	44,103	43,673	198,135
1948	54,478	45,164	20,288	41,502	41,490	202,922
1949	70,658	47,703	20,443	29,346	40,670	208,820
1950	60,480	45,776	21,606	29,263	31,678	188,803
1951	52,999	55,714	17,443	45,419	34,317	205,892
1952	47,143	53,203	15,357	50,975	32,947	199,625
1953	27,530	37,809	5,812	13,373	29,184	113,708
1954	21,461	35,150	1,035	6	34,031	91,683
1955	22,684	35,350	2,670	15,277	43,556	119,537
1956	25,580	40,246	7,488	35,010	42,374	150,698
1957	33,905	47,000	5,292	32,680	40,846	159,230
1958	28,532	37,132	91	9,034	44,982	119,771
1959	37,325	35,388	217	4,636	35,223	112,789
1960	35,811	31,278	420	13,770	35,476	116,755
1961	29,585	42,647	453	22,900	37,239	132,914
1962	32,888	43,351	281	22,015	34,313	132,848
1963	25,419	48,109	571	12,938	36,179	123,216
1964*	25,450	51,530	270	29,600	32,000	138,850

*Preliminary

TABLE II
Relation of Zinc Production in
Southwest to Total U. S. Production
Short Ton "Recoverable" Zinc

	S. West States	Total U. S.	% Total - SW
1920	39,559	586,384	6.75
1921	1,364	256,746	.53
1922	17,851	472,032	3.86
1923	48,332	610,690	7.90
1924	53,526	637,977	8.39
1925	77,440	710,847	10.86
1926	104,024	774,563	13.43
1927	119,566	718,541	16.63
1928	117,900	695,170	16.96
1929	125,085	724,478	17.27
1930	128,918	595,425	21.65
1931	91,775	410,318	22.37
1932	55,495	285,002	19.47
1933	68,347	384,280	17.79
1934	70,337	438,726	16.03
1935	73,508	517,903	14.19
1936	75,098	575,574	13.05
1937	95,437	626,362	15.24
1938	81,205	516,703	15.72
1939	78,651	583,807	13.47
1940	106,450	665,068	16.01
1941	127,255	749,125	16.99
1942	152,938	768,025	19.91
1943	183,801	744,196	24.70
1944	179,452	718,642	24.97
1945	171,381	614,358	27.90
1946	166,856	574,833	29.03
1947	198,135	637,608	31.07
1948	202,922	629,977	32.21
1949	208,820	593,203	35.20
1950	188,803	623,375	30.29
1951	205,892	681,189	30.23
1952	199,625	666,001	29.97
1953	113,708	547,430	20.77
1954	91,683	473,471	19.36
1955	119,537	514,671	23.23
1956	150,698	542,340	27.79
1957	159,230	531,735	29.95
1958	119,771	412,005	29.07
1959	112,789	425,303	26.52
1960	116,755	435,427	26.81
1961	132,914	464,390	28.62
1962	132,848	505,491	26.28
1963	123,216	529,254	23.28
1964*	138,850	574,000	24.19

*Estimate

TABLE III
Zinc Production in Mexico
(From U.S.B.M.)

	Metric Tons	Short Tons
1920	?	
1921	1,257	1,386
1922	6,342	6,991
1923	18,481	20,768
1924	24,659	27,182
1925	51,795	57,094
1926	105,367	116,146
1927	137,724	151,813
1928	161,747	178,294
1929	174,050	191,855
1930	124,106	136,802
1931	120,307	132,614
1932	57,000	62,831
1933	89,339	98,478
1934	125,000	136,685
1935	136,000	149,913
1936	150,250	165,620
1937	154,625	170,443
1938	172,000	189,596
1939	134,000	147,708
1940	109,000	120,151
1941	154,966	170,819
1942	189,278	208,541
1943	197,199	217,372
1944	219,309	241,744
1945	209,940	231,417
1946	139,535	153,809
1947	195,814	215,845
1948	179,029	197,344
1949	178,402	196,652
1950	223,530	246,397
1951	180,064	198,485
1952	227,375	250,638
1953	226,541	249,715
1954	223,571	246,441
1955	269,403	296,961
1956	248,891	274,351
1957	243,030	267,891
1958	224,108	247,033
1959	263,939	290,938
1960	262,429	289,274
1961	268,977	296,492
1962	250,687	276,330
1963	241,100	265,763
1964	Not Available	

TABLE IV

E&MJ Annual Average Metal Prices—1899 to 1964

Year	COPPER (a) Domestic Refinery	COPPER Foreign Refinery	LEAD Common N. Y.	ZINC PW (b) E. St. Louis	TIN (c) N. Y.	SILVER (e) N. Y.	MERCURY (f) N. Y.	ALUMINUM Ingot
1899	16.67	.....	4.470	5.750	25.12	59.580	43.63	32.72
1900	16.19	.....	4.370	4.390	29.90	61.330	51.00	32.72
1901	16.11	.....	4.330	4.070	16.74	58.950	47.00	33.00
1902	11.026	.....	4.069	4.840	26.79	52.160	48.03	33.00
1903	13.235	.....	4.237	5.191	28.09	53.570	41.32	33.00
1904	12.823	.....	4.309	4.931	27.99	57.221	41.00	35.00
1905	15.590	.....	4.707	5.730	31.358	60.352	38.50	35.00
1906	19.278	.....	5.657	6.048	39.819	66.791	40.90	35.75
1907	20.004	.....	5.325	5.812	38.166	65.237	41.50	45.00
1908	13.208	.....	4.200	4.578	29.465	52.864	44.84	28.70
1909	12.982	.....	4.273	5.352	29.725	51.502	46.30	22.00
1910	12.738	.....	4.446	5.370	34.123	53.486	47.06	22.25
1911	12.376	.....	4.420	5.608	42.281	53.304	46.54	30.07
1912	16.341	.....	4.471	6.799	46.096	60.835	42.46	22.01
1913	15.269	.....	4.370	5.504	44.252	59.791	39.54	23.64
1914	13.602	.....	3.862	5.061	34.301 (d)	54.811	48.31	18.63
1915	17.275	.....	4.673	13.054	38.590	49.684	87.01	33.98
1916	27.202	.....	6.858	12.634	43.480	65.661	125.49	60.71
1917	27.180	.....	8.787	8.813	61.802	81.417	106.30	51.59
1918	24.628	.....	7.413	7.890	88.750	96.772	123.47	33.53
1919	18.691	.....	5.759	6.988	63.328	111.122	92.15	32.14
1920	17.456	.....	7.957	7.671	48.273	100.900	81.12	32.72
1921	12.502	.....	4.545	4.655	29.916	62.654	45.46	21.11
1922	13.382	.....	5.734	5.716	32.554	67.528	58.95	18.68
1923	14.421	.....	7.267	6.607	42.664	64.873	66.50	25.41
1924	13.024	.....	8.097	6.344	50.176	66.781	69.76	27.03
1925	14.042	.....	9.020	7.622	57.893	69.065	83.13	27.19
1926	13.795	.....	8.417	7.337	65.285	62.107	91.90	26.99
1927	12.920	.....	6.755	6.242	64.353	56.370	118.16	25.40
1928	14.570	.....	6.305	6.027	50.427	58.176	123.51	24.300
1929	18.107	.....	6.833	6.512	45.155	52.993	122.15	24.300
1930	12.982	.....	5.517	4.556	31.694	38.154	115.01	23.787
1931	8.116	.....	4.243	3.640	24.467	28.700	87.35	23.300
1932	5.555	.....	3.180	2.876	22.017	27.892	57.93	23.300
1933	7.025	6.713	3.869	4.029	39.110	34.727	59.23	23.300
1934	8.428	7.271	3.866	4.158	52.191	47.973	73.87	23.300
1935	8.649	7.538	4.065	4.328	50.420	64.273	71.99	20.000
1936	9.474	9.230	4.710	4.901	46.441	45.087	79.92	20.000
1937	13.167	13.018	6.009	6.519	54.337	44.883	90.18	19.917
1938	10.000	9.695	4.739	4.610	42.301	43.225	75.47	30.000
1939	10.965	10.727	5.053	5.110	50.323	39.082	103.94	10.000
1940	11.296	10.770	5.179	6.335	49.827	34.773	176.86	18.691
1941	11.797	10.901	5.793	7.474	52.018	34.783	185.02	16.500
1942	11.775	11.684	6.481	8.250	52.000	38.333	196.35	15.000
1943	11.775	11.700	6.500	8.250	52.000	44.750	195.21	15.000
1944	11.775	11.700	6.500	8.250	52.000	44.750	118.36	15.000
1945	11.775	11.700	6.500	8.250	52.000	51.928	134.89	15.000
1946	13.820	14.791	8.109	8.726	54.544	80.151	98.24	15.000
1947	20.958	21.624	14.673	10.500	77.949	71.820	83.74	15.000
1948	22.038	22.348	18.043	13.589	99.250	74.361	76.49	15.733
1949	19.202	19.421	15.364	12.144	99.336	71.930	79.46	17.000
1950	21.235	21.549	13.296	13.866	95.539	74.169	81.26	17.713
1951	24.200	26.258	17.500	18.000	127.077	89.368	210.13	19.000
1952	24.200	31.746	16.467	16.215	120.473	84.941	199.097	19.410
1953	28.798	30.845	13.489	10.855	95.845	85.188	193.032	20.931
1954	29.694	29.889	14.054	10.681	91.838	85.250	264.386	21.784
1955	37.491	39.115	15.138	12.299	94.735	89.099	290.348	23.668
1956	41.818	40.434	16.013	13.494	101.409	90.826	259.923	24.032 (g)
1957	29.576	27.157	14.658	11.399	96.261	90.820	246.978	25.416
1958	25.764	24.123	12.109	10.309	95.127	89.044	229.057	24.790
1959	31.182	28.892	12.211	11.448	102.053	91.202	227.484	24.738
1960	32.053	29.894	11.948	12.946	101.438	91.375	210.760	26.000
1961	29.921	27.919	10.871	11.542	113.311	92.449	197.605	25.458
1962	30.600	28.514	9.631	11.625	114.652	108.521	191.208	23.875
1963	30.600	28.413	11.137	11.997	116.652	127.912	189.451	22.623
1964	31.960	30.985	13.596	13.568	157.595	129.300	314.787	23.741

(a) Lake copper 1897–98: domestic market since 1932. (b) New York delivery 1898–1902. (c) 99% in 1897 to 1920, inclusive: Straits quality thereafter. (d) Average for 11 months. (e) New York market. . . . All quotations in cents per lb, except for silver, which is in cents per troy oz, and (f) mercury, which is in dollars per flask of 76 lb. See opposite page and reverse for weekly average prices for 1964. (g) Unalloyed ingot beginning 1956.

TABLE V

Possible Additional Sources of Zinc in Next 10 Years

Ton Recoverable Zinc

Source	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Mission	9,000	9,000	9,000	9,000	9,000	10,000	10,000	10,000	10,000	10,000
Continental	----	5,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
ASARCO--Res.	----	----	----	12,000	16,000	16,000	16,000	16,000	16,000	16,000
Ground Hog	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Twin Buttes	----	----	----	----	5,000	10,000	10,000	10,000	10,000	10,000
Pima	----	----	----	----	3,000	5,000	8,000	8,000	8,000	8,000
Iron King	----	----	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)
Total	24,000	29,000	20,000	32,000	44,000	52,000	55,000	55,000	55,000	55,000

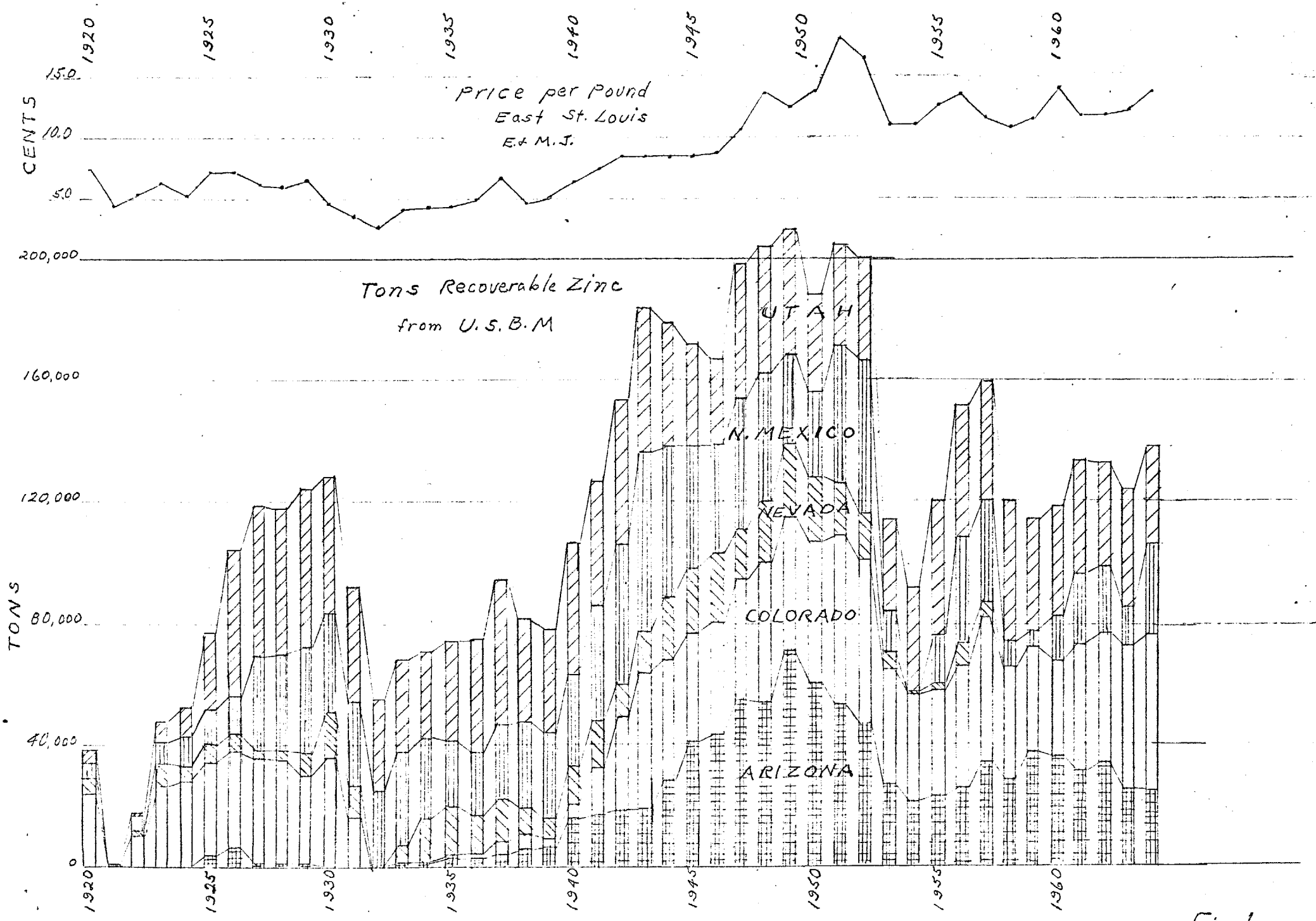

Price per Pound
East St. Louis
E. & M. J.
CENTS
15.0
10.0
5.0
1920
1925
1930
1935
1940
1945
1950
1955
1960
Tons Recoverable Zinc
from U.S.B.M
TONS
200,000
160,000
120,000
80,000
40,000
0
UTAH
N. MEXICO
NEVADA
COLORADO
ARIZONA

Fig 1

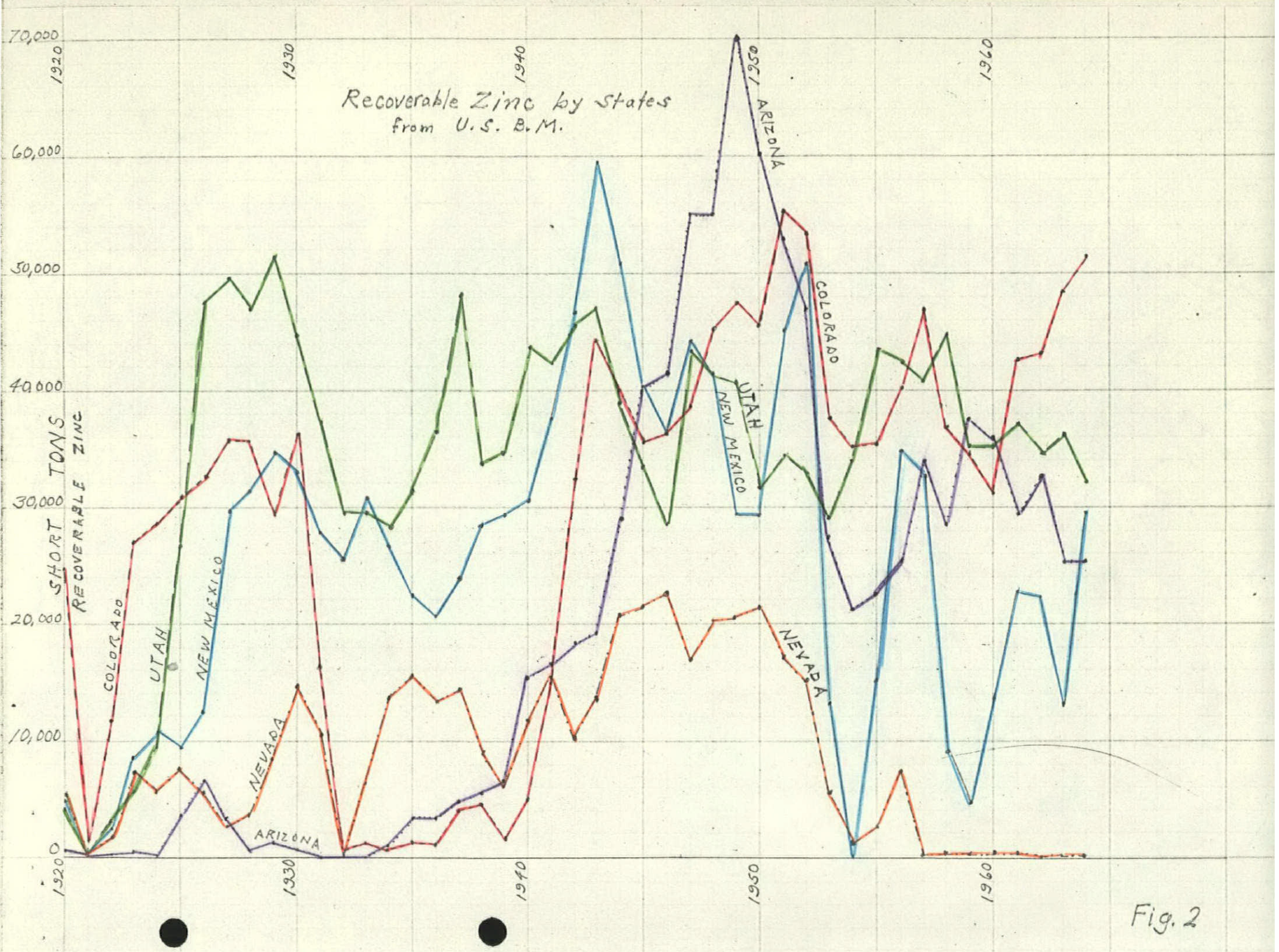

Recoverable Zinc by States
from U.S. B.M.
SHORT TONS
RECOVERABLE ZINC
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1920
1930
1940
1950
1960
COLORADO
UTAH
NEW MEXICO
NEVADA
ARIZONA

Fig. 2

Southwestern Zinc Production
as
Percentage of Total U.S
Production

Fig. 3

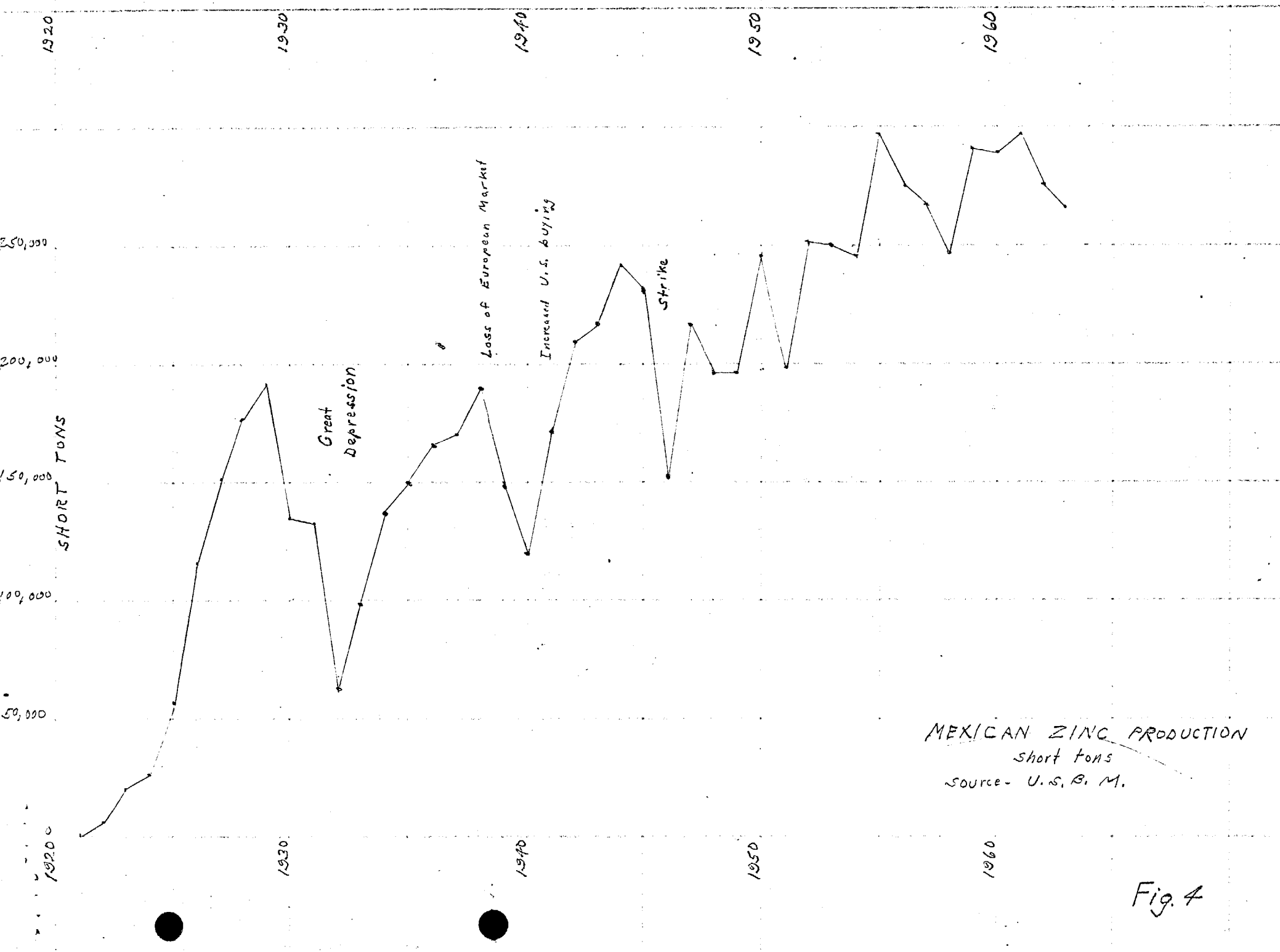

1920
1930
1940
1950
1960
250,000
200,000
150,000
100,000
50,000
SHORT TONS
Great Depression
Loss of European Market
Increased U.S. buying
Strike
MEXICAN ZINC PRODUCTION
short tons
source - U.S.B.M.

Fig. 4

KEEP THIS ON TOP

ZINC

File No. 13-19.13C-(26

Subject: Metals and Minerals

Miscellaneous file

See file 13-19.2A - Wayne Burnham Thesis, 1955 on "Metallogenic Provinces of Western U.S. and Mexico"

13-19.13 C-C26

Zinc - Misc

September 28, 1965

Mr. Alan D. Hoagland
The New Jersey Zinc Co.
Jefferson City, Tennessee

Dear Mr. Hoagland:

Thank you for the reprint of your paper on the "Genesis of the Ordovician Zinc Deposits in East Tennessee." It was very thoughtful of you to send it, which I have read with much interest.

Very truly yours,

R. K. Kirkpatrick

RKK:bam

13-19. 13C-(26)
Zinc

March 3, 1964

Mr. Alan D. Hoagland
The New Jersey Zinc Company
Jefferson City, Tennessee

Dear Mr. Hoagland:

Mr. Courtright and I have read with interest the abstract of the paper by you and Messrs. Hill and Fulweiler, "Observations Relating to the Genesis of the East Tennessee Zinc Deposits," which appeared in the program of the 1963 Annual Meeting of the G.S.A. Your explanation for the localization of the deposits is a subject in which we are particularly interested; if by chance you have an extra copy of the complete paper that you could spare, we would greatly appreciate receiving one.

Very truly yours,

ORIGINAL SIGNED BY
R. K. KIRKPATRICK

R. K. Kirkpatrick

RKK:bam
cc: JHCourtright

Ewin.

A REVIEW OF THE ZINC INDUSTRY IN THE UNITED STATES DURING 1957

BY J. L. KIMBERLEY
Executive Vice President
AMERICAN ZINC INSTITUTE, INC.

60 East Forty-second Street, New York 17, N. Y.
January 31, 1958

U. S. TOTAL SLAB ZINC OUTPUT (All Grades) 1937-1957

Tons of 2000 lbs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			SHIPMENTS						
	Stock Beginning	Production	Domestic	Export and Drawback	Government Account	Total	Stock at End	Unfilled Orders at End	Daily Average Production
1937	44,955	589,619	569,241	.....	.....	569,241	65,333	48,339	1,615
1938	65,333	456,990	395,554	20	.....	395,554	126,769	40,829	1,252
1939	126,769	538,198	598,972	.....	.....	598,972	66,995	53,751	1,475
1940	74,262	706,100	674,615	88,165	.....	762,780	17,582	125,132	1,929
1941	17,582	863,955	751,276	106,195	.....	857,471	24,066	87,666	2,367
1942	24,066	929,770	733,918	151,650	.....	885,568	68,268	52,752	2,547
1943	89,275	971,873	831,430	56,208	.....	887,638	173,510	44,914	2,663
1944	173,510	901,332	830,334	6,988	.....	837,322	237,520	21,332	2,463
1945	237,520	799,620	762,925	9,422	5,302	777,649	259,391	27,092	2,190
1946	259,391	759,346	714,292	66,638	62,007	842,937	175,800	58,057	2,080
1947	175,800	848,027	698,281	117,305	140,230	955,816	68,011	59,705	2,323
1948	68,647	850,106	770,396	69,910	57,598	897,904	20,848	51,318	2,323
1949	20,848	870,113	648,285	56,929	91,526	796,740	94,221	42,625	2,384
1950	94,221	910,354	849,246	18,189	128,256	995,691	8,884	74,795	2,494
1951	8,884	931,833	836,800	42,067	39,949	918,816	21,901	50,509	2,553
1952	21,901	961,430	803,343	56,202	36,626	896,171	87,160	45,264	2,627
1953	87,160	971,191	818,850	16,326	42,332	877,508	180,843	35,466	2,661
1954	180,843	868,242	787,922	27,929	108,957	924,808	124,277	45,862	2,379
1955	124,277	1,031,018	1,007,619	19,497	87,200	1,114,316	40,979	72,908	2,825
1956	40,979	1,062,954	869,270	9,027	157,014	1,035,311	68,622	34,913	2,904
1957									
January	68,622	93,452	67,273	450	15,377	83,100	78,974	42,922	3,014
February	78,974	88,078	67,731	1,527	10,905	80,163	86,889	56,421	3,146
March	87,040	96,924	67,441	1,558	25,608	94,607	89,357	56,818	3,127
April	89,357	96,506	55,000	1,411	23,921	80,332	105,531	42,102	3,217
May	105,531	96,855	60,729	2,106	26,858	89,693	112,693	31,539	3,124
June	112,693	90,719	54,275	1,358	14,324	69,957	133,455	28,822	3,024
July	133,455	85,779	57,862	4,007	11,186	73,055	146,179	28,296	2,767
August	146,179	84,166	70,318	860	9,871	81,049	149,296	30,890	2,715
September	149,296	77,455	62,111	530	10,344	72,985	153,766	32,379	2,582
October	153,766	81,492	66,225	372	12,736	79,333	155,925	31,466	2,629
November	155,925	79,754	73,437	581	9,148	83,166	152,513	21,867	2,658
December	152,513	86,270	62,730	210	9,188	72,128	166,655	18,217	2,783
		1,057,450	765,132	14,970	179,466	959,568			
Monthly Average		88,121	63,761	1,247	14,956	79,964	Daily	Average	2,897

TABLE I

A Review of The Zinc Industry in the United States during 1957

1957 has been one of the better consuming years for the zinc industry, although a difficult one over-all. This is true not only in the United States but also throughout the free world. Continued production in excess of a good demand, and a drop in United States prices by stages — from 13.50 cents to 10.00 cents during the period May 6 to July 1, — have resulted in serious and general problems. This, in spite of the fact that domestic shipments to government account were up 14 per cent and that the year's consumption in the United States will be off no more than 5 or 6 per cent from that of 1956. As evidence of the problem, stocks in the hands of domestic producers increased from 68,622 tons to 166,655 tons during calendar 1957. Favorably, during the ten month period December 31, 1956 to October 31, 1957, consumer stocks of slab zinc decreased from 104,963 tons to 72,111 tons.

The downturn for zinc became apparent shortly after the spring announcement of the Government's long range minerals program, coupled with a temporary suspension of the barter program.

Reaction was prompt. Starting in May, there was an increasing amount of activity on the part of both Houses of Congress for assistance to the lead and zinc industries. A National Emergency Lead-Zinc Committee was created and from June through the first half of December, more than ten bills, aimed at betterment of the domestic mining situation, were introduced in both Houses of Congress, — the Senate Finance Committee held public hearings July 22, 23 and 24 — the House Ways and Means Committee held public hearings August 1 and 2 — the President in August invited the U. S. Tariff Commission to consider the situation for action under the escape clause of the Trade Agreements Exten-

sion Act — in September the National Emergency Lead-Zinc Committee asked the Tariff Commission to invoke the escape clause of the Trade Agreements Extension Act and public hearings were held November 19 through 26.

What resultant action will be taken, if any, is not known. Under existing laws, the Tariff Commission can recommend an increase in the tariff on slab zinc from the current .7 cent per pound to 2.1 cents per pound (150 per cent of the 1.40 cent tariff as it stood in 1945).

The American Zinc Institute wishes to emphasize its opinion that excess world production is the base of the problem and that this should not be permitted to influence thinking or planning on zinc's long range and large future in the industrial pattern of usage. Examination of the consumption chart, Figure 1, on page 11, will show consistently that the yearly consumption figures are subject to peaks and valleys and that the trend has been steadily upward since 1932. There is much evidence to indicate that the years 1956 and 1957, consumptionwise were normal in the over-all pattern.

Table II

Slab Zinc Consumption in Certain Countries

(Tons of 2000 lbs.)

Country	1956 Consumption Jan.-Sept. incl.	1957 Consumption Jan.-Sept. incl.	% Change '57 vs '56
United States	723,900	692,200	— 4
Canada	43,600	37,400	—14
Mexico	12,300	12,900	+ 5
Denmark	3,200	4,200	+31
France	105,000	116,100	+10
Fed. Rep. of Germany	174,900	181,700	+ 4
Italy	42,000	56,300	+34
Netherlands	14,800	21,300	+44
Sweden	21,000	16,900	—20
Switzerland	7,900	9,400	+19
United Kingdom	188,800	192,000	+ 2
Australia	55,400	64,700	+17
India	29,600	35,400	+20
Total	1,422,400	1,440,500	+ 1

Source: American Bureau of Metal Statistics

It is interesting to observe from Table II that the January-September, inclusive, consumption of zinc has risen one per cent

over-all in thirteen countries for which comparative consumption figures are currently available, — in spite of the fact that consumption decreased in the United States, Canada, and Sweden.

Significant basic statistics, with respect to the domestic situation, are summarized in Table III.

Table III

Salient Statistics on Slab Zinc for 1957

	1956 (Tons)	1957 (Tons)	% Change '57 vs '56
[1]Mine Production (Jan.-Oct. incl.)	449,762	442,158	— 1¾
[2]Slab Zinc Production (full year)	1,062,954	1,057,450	— ½
[2]Total Slab Shipments (full year)	1,035,311	959,568	— 8
[2]Shipments Domestic (full year)	869,270	765,132	— 12
[2]Shipments Gov't. Acct. (full year)	157,014	179,466	+ 14
[2]Shipments Export (full year)	9,027	14,970	+ 66
[2]Stocks at Smelters *(Dec. 31)*	68,622	166,655	+142
[1]Stocks at Consumers *(Oct. 31)*	93,896	72,111	— 23
[1]Consumption (Jan.-Oct. incl.)	818,601	780,047	— 5

[1]U. S. Bureau of Mines
[2]American Zinc Institute, Inc.

In a review of this nature, it is common to offer a prediction covering things to come. It would appear that the usage of zinc during 1958 will be essentially parallel to the general level of industrial activity. As of this writing, there is little consistency in the opinion of experts concerning 1958, although perhaps a majority expect a continuance of over-all activity during the first half of 1958 at a level slightly below the last half of 1957, followed by an increase in activity after June. It may be significant that General Motors estimates 5,500,000 cars in 1958 as compared to 5,800,000 for 1957. To the Institute's knowledge, there has been no significant decrease in plans for industrial expansion. This, of course, indicates a basic and underlying optimism.

The zinc industry, with a permanent and growing position in the basic and major markets of die casting, galvanizing, brass, rolled zinc, chemicals, and pigments, is also thoroughly aware of the need for the development of new markets. Recognizing that the most direct approach to consolidation and expansion of existing markets, and the discovery of new ones, is to be found in research, both applied and fundamental, the industry through

the American Zinc Institute is currently in process of arranging for a major expansion in research activities. Staff expansion is in progress and a broad placement of projects is planned with research centers, universities, and engineering schools. Foreign as well as domestic producers will be involved in the financing and supervision of the enlarged program.

The industry was quite free of labor troubles during the year, with two minor and one major strike at smelters and only one strike at a mine.

The foregoing is intended as a summary of the situation throughout the year and includes some expression of Institute opinion. That which follows is a more complete tabulation of the data from which the opinions and facts expressed have been derived, along with such additional comment as seems pertinent.

SUPPLY

Slab Zinc Production

Basic domestic slab production figures for 1957 are to be seen in Table I, page 2.

Production by grades is shown in Table IV.

Table IV

U. S. Production of Slab Zinc According to Grade

(Tons of 2000 lbs.)

	1953[1]	1954[1]	1955[1]	1956[1]	1957[2]
Special High Grade	312,810	270,159	378,215	356,756	356,098
High Grade	180,188	132,980	138,597	162,467	145,105
Intermediate	14,720	19,284	23,792	37,691	24,225
Brass Special	56,219	52,662	80,209	96,291	
Selected	1,930	1,233	3,904	2,400	532,022
Prime Western	403,113	394,120	404,829	400,132	
Total U.S.	968,980	870,438	1,029,546	1,055,737	1,057,450

[1]Source: U. S. Bureau of Mines
[2]Preliminary — AZI

Mine Production

Table V shows domestic mine production by basic areas starting 1953. The ten month production figures for 1957, extended arithmetically to twelve months, would indicate — a 15 per cent gain in mining east of the Mississippi, — a 42 per cent decrease in the Tri-State area, — a 4 per cent decrease in the western states — and a net decrease for the country of 2½ per cent. (All comparisons vs. 1956, 12 months.)

Table V

U. S. Mine Production

Tons of 2000 lbs. (Recoverable Zinc.)

	States East of the Mississippi	West Central States Arkansas, Kansas Missouri, Oklahoma	Western States	Total U.S.
1953	184,245	58,909	304,276	547,430
1954	168,098	67,491	237,882	473,471
1955	163,230	73,630	277,811	514,671
1956	177,343	60,560	304,437	542,340
1957 Jan.-Oct.	169,120	29,153	243,885	442,158[1]
AZI 1957 Estimate, 10-month total extended to 12	203,000 (+15%)	35,000 (—42%)	292,000 (—4%)	530,000 (—2½%)

Source: U. S. Bureau of Mines
[1]January-October inclusive (preliminary)

Slab Zinc Imports

Table VI shows the nine month total of slab zinc imported and includes metal "entered duty-free in bond" as well as "duty-paid." The duty-free totals available to the Institute are indicated in footnote 2. The nine month comparison between 1956 and 1957 on imported slab indicates an increase of 49 per cent. It is not known whether this increase is influenced by the barter program, under which it is understood that relatively heavy tonnages were imported in late 1956 and early 1957.

Table VI
Slab Zinc Imports
(Tons of 2000 lbs.)

From	1953	1954	1955	1956	(Jan.-Sept.) 1957[1]	(Jan.-Sept.) 1956
Australia	3,951	3,080	4,032	7,390	8,402	3,470
Austria	.....	.....	.....	2,186	633	1,740
Belgian Congo	882	13,895	15,227	17,782	22,561	10,280
Belgium & Luxembourg	21,549	7,540	17,750	32,354	26,814	17,266
Canada	107,925	105,154	113,401	116,877	76,841	73,109
Fr. Morocco	.....	.....	1,264	.....	.....	.....
Italy	23,972	5,285	6,189	13,486	8,247	7,611
Japan	.....	.....	.....	4,884	2,887	2,114
Mexico	33,878	9,726	19,480	17,154	17,465	10,699
Mozambique	.....	112	.....	1,568	1,230	560
Netherlands	4,338	1,461	1.078	5,964	2,504	1,304
Norway	6,323	717	504	.....	.....	.....
Peru	8,406	6.757	9,767	6,589	18,710	4,998
Rhodesia	1,064	.....	281	560	2,184	.....
Switzerland	165	.....	.....	.....	.....	.....
Trieste, Territory of	.....	.....	.....	110	.....	.....
Union of South Africa	.....	.....	.....	1,680	560	.....
United Kingdom	6,317	22	79	610	1,790	610
West Germany	13,906	3,109	6,643	15,282	8,716	5,881
Yugoslavia	1,900	.....	.....	500	8,807	224
Total	234,576[2]	156,858[2]	195,695[2]	244,976[2]	208,351[2]	139,866[2]

Source: Bureau of the Census, U. S. Department of Commerce
[1]January-September inclusive (preliminary)
[2]Included in these totals are duty-free entries for Government Account.
In 1953—19,938 tons. In 1954—10,846 tons. In 1955—9,854 tons. In 1956—79,924 tons. In 1957 (Jan.-Sept.)—65,925 tons. In 1956 (Jan.-Sept.)—18,437 tons.

Ore Imports

Table VII shows the importation of ore starting 1953. A great majority of this ore was processed into slab at United States refineries which is included with domestic production, see Table I, page 2.

Table VII

Zinc Ore Imports (Zinc Content)

(Tons of 2000 lbs.)

From	1953	1954	1955	1956	(Jan.-Sept.) 1957	(Jan.-Sept.) 1956
Algeria	2,804	.....	.....	.....	.....	.....
Argentina	.....	.....	.....	3	83	.....
Australia	10,820	2,361	5,630	17,766	6,351	16,469
Belgium & Luxembourg	.....	.....	1,546	861	.....	861
Bolivia	22,528	11,440	1,833	7,292	4,276	5,544
Burma	778	.....	.....	.....	.....	.....
Canada	165,910	156,830	173,157	177,086	111,548	130,686
Chile	3,247	1,797	4,858	346	1,400	77
Colombia	389	31	142	204	1	68
Costa Rica	.....	.....	.....	4	.....	4
Cuba	.....	.....	3,704	1,159	818	829
Ecuador	.....	.....	.....	8	4	6
France	1	.....	.....	.....	.....	.....
Greece	.....	15	.....	.....	.....	.....
Guatemala	6,477	3,755	8,353	11,432	7,887	8,933
Honduras	636	792	1,433	2,291	2,054	1,826
Iran	1	.....	.....	.....	.....	.....
Italy	8,738	.....	.....	.....	.....	.....
Korea	.....	.....	.....	66	24	66
Malta	.....	.....	.....	1,062	1,117	687
Mexico	169,124	175,692	186,461	193,004	139,222	143,094
Netherlands	3,009	.....	.....	.....	.....	.....
Peru	84,365	93,216	83,915	98,539	87,118	77,666
Philippines	2,104	444	465	829	768	448
Portugal	.....	.....	.....	.....	62	.....
Rhodesia	.....	.....	.....	.....	123	.....
Spain	8,617	.....	.....	.....	.....	.....
Turkey	.....	.....	.....	.....	54	.....
Union of South Africa	13,356	4,183	5,050	13,399	19,692	6,125
United Kingdom	.....	.....	1,497	.....	52	.....
West Germany	.....	.....	.....	.....	8	.....
Yugoslavia	10,820	4,871	.....	.....	.....	.....
Total	513,724	455,427	478,044	525,351	382,662[1]	393,389

Source: Bureau of the Census, U. S. Department of Commerce
[1]January-September inclusive (preliminary)

CONSUMPTION

Slab Zinc Consumption United States

Table VIII shows the consumption of zinc by industry for the period starting 1953 through October 1957, inclusive. Figure I, page 11 shows the same basic information, for a longer period of time, in graphic form.

Table VIII

U. S. Slab Zinc Consumption

(Tons of 2000 lbs.)

	1953	1954	1955	1956	(Jan.-Oct.) 1957	1957 AZI	% Change '57 vs '56
Galvanizing	406,988	403,463	451,141	439,146	303,388	363,000	—17
Brass Products	178,182	108,268	146,243	124,004	93,236	112,000	—10
Zinc-Base Alloys	307,445	290,846	430,807	360,507	309,144	371,000	+ 3
Rolled Zinc	54,649	47,486	51,589	47,359	34,022	41,000	—13
Zinc Oxide (French Process)	20,675	18,701	22,433	19,160	17,804	22,000	+15
Other	17,988	15,535	17,599	18,614	22,453	27,000	+45
Total U. S.	985,927	884,299[1]	1,119,812[2]	1,008,790[3]	780,047[4]	936,000[5]	— 7

Source: U. S. Bureau of Mines
[1]Includes 3589 tons of remelt zinc
[2]Includes 2997 tons of remelt zinc
[3]Includes 5230 tons of remelt zinc
[4]January-October inclusive (preliminary) includes 9000 tons estimated unreported tonnage
[5]AZI Estimate for 12 months (10 months' total extended arithmetically)

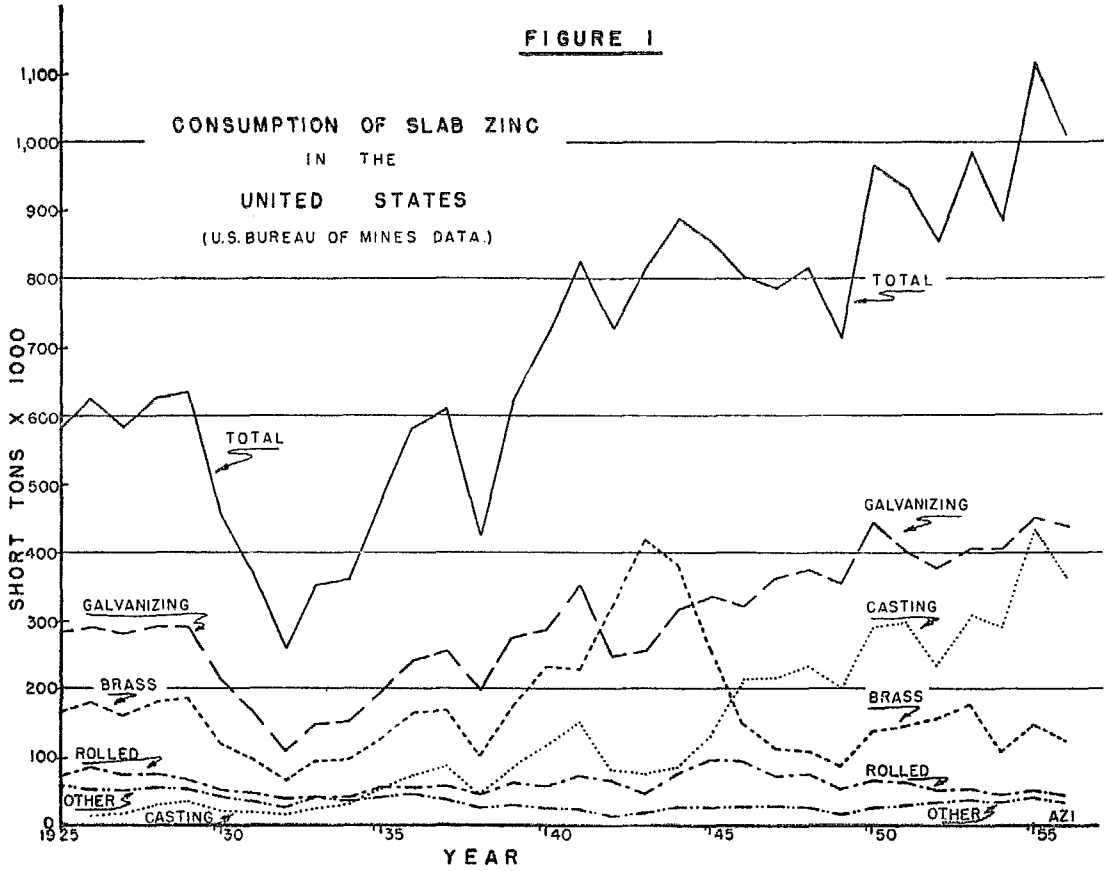


FIGURE I
CONSUMPTION OF SLAB ZINC
IN THE
UNITED STATES
(U.S. BUREAU OF MINES DATA.)
SHORT TONS X 1000
1,100
1,000
900
800
700
600
500
400
300
200
100
0
1925
'30
'35
'40
'45
'50
'55
YEAR
TOTAL
TOTAL
GALVANIZING
GALVANIZING
CASTING
BRASS
BRASS
ROLLED
ROLLED
OTHER
OTHER
CASTING
AZI

It is to be noted that the use of zinc for die casting has remained high, in fact may well prove to have shown a gain for the year when actual year-end figures are available. The decrease in usage of zinc for galvanizing is definite and is not accounted for by a decrease in the production of steel. No information has reached the American Zinc Institute to indicate that this loss results from the adoption of any other competitive means for protecting steel; it is believed to be temporary. The gains in usage for French process zinc oxide and for miscellaneous purposes are healthy.

Table IX shows the use of zinc by grades, 1953 through October 1957.

Table IX

U. S. Zinc Uses by Grades

(Tons of 2000 lbs.)

	1953	1954	1955	1956	(Jan.-Oct.) 1957
Special High Grade	375,276	347,311	494,466	426,246	351,961
High Grade	137,616	91,069	105,640	89,540	69,977
Intermediate	21,507	22,149	25,118	21,929	14,250
Brass Special	55,184	61,508	73,581	95,397	64,191
Selected	3,843	1,771	5,366	3,730	1,291
Prime Western	388,791	356,902	412,644	366,718	263,495
Remelt	3,710	3,589	2,997	5,230	5,882
Total U. S.	985,927	884,299	1,119,812	1,008,790	771,047[1]

Source: U. S. Bureau of Mines

[1]January-October inclusive (preliminary) does not include estimated unreported tonnage of 9000 tons

Exports

Table X covers exports of slab, rolled zinc and zinc scrap, 1953 through the first nine months of 1957.

Table X

Exports

(Tons of 2000 lbs.)

	Slab Zinc	Sheet & Strip	Zinc Scrap
1953	17,858	3,238	999
1954	24,994	2,957	16,689
1955	17,904	2,603	21,612
1956	8,815	1,530[1]	12,694
1957	9,889[2]	2,058[2]	4,514[2]

Source: Bureau of the Census, U. S. Department of Commerce

[1]This figure covers July-December 1956 only. Breakdown on exports of Sheet and Strip was not available January-June 1956 because of temporary Commodity Code Reclassification by USDC.

[2]January-September inclusive (preliminary)

PRICES

The subject of price movement during the year has been touched upon in the introductory remarks of this review. For the record, actual movements were as indicated below:

Slab Prices

Prime Western Zinc, F.O.B., East St. Louis

January 1 to May 6	—	13½ cents lb.
May 6 to May 13	—	12 " "
May 13 to June 4	—	11½ " "
June 4 to June 19	—	11 " "
June 19 to July 1	—	10½ " "
July 1 to date	—	10 " "

ZINC OXIDE

The production and shipment of zinc oxide, both leaded and lead-free, during the first ten months of 1957 as reported by the U. S. Bureau of Mines was on a stable basis. An arithmetic extension of the ten month figures indicates that both production and shipments during 1957 will have been at essentially the same rate as in 1956. Table XI shows these data as available 1955 through October 1957.

Table XI

Production and Shipments of Zinc Oxide

Both French and American Processes

(Tons of 2000 lbs.)

		Lead-free	Leaded	Total
1955	Production	169,381	29,808	199,189
	Shipments	168,488	32,778	201,266
1956	Production	158,493	26,407	184,900
	Shipments	154,367	27,267	181,634
1957 Jan.-Oct.	Production	129,818	23,636	153,454
	Shipments	130,720	21,998	152,718

Source: U. S. Bureau of Mines

Table XII shows the concentrates, ore and ore residues consumed in the production of zinc oxide for the same period. The arithmetic extension of the ten month figures indicates that production of zinc oxide from the sources named will have been at a slightly lesser rate than 1956. It would appear that this decrease will have been compensated for by the increasing use of slab zinc for French process zinc oxide as discussed elsewhere in this review and shown previously in Table VIII.

Table XII

Raw Material Consumed in Production of Zinc Oxide[1]

(Tons of 2000 lbs.)

		Zn Ore and Concentrates	Ore Residues	Total
1955	Gross Wt.	142,258	52,067	194,325
	Zn Content	85,052	31,311	116,363
1956	Gross Wt.	147,564	35,588	183,152
	Zn Content	95,114	20,842	115,956
1957 Jan.-Oct.	Gross Wt.	114,093	31,921	146,014
	Zn Content	75,316	17,998	93,314

Source: U. S. Bureau of Mines

[1]Excludes slab zinc, zinc dust residues, secondary residues, scrap zinc and remelt zinc

Although no details on consumption of zinc oxide are available, it is apparent that its use did not follow the downward trend evidenced in the use of slab zinc. Main markets for zinc oxide continue in the paint, rubber, and chemical industries. In addition, there is evidence that new uses are being developed, including photosensitive materials.

TARIFFS

Table XIII and the remarks on the subject, which follow, indicate today's situation.

Table XIII

Tariff Rates

	(1) Tariff Act of 1930	(2) Canadian Agreement Jan. 1, 1939	(3) Geneva Agreement Jan. 1, 1948	(4) Torquay Agreement June 6, 1951
Zinc-bearing ores, except pyrites containing not more than 3% zinc (rates apply on zinc content)	1.50c lb.	1.20c lb.	.75c lb.	.60c lb.
Zinc in blocks or slabs and zinc dust	1.75c lb.	1.40c lb.	.87½c lb.	.70c lb.
Zinc sheets	2.00c lb.	x	1.00c lb.	x
Zinc sheets coated or plated	2.25c lb.	x	1.12½c lb	x
Old and worn-out zinc, fit only to be remanufactured	1.50c lb.	x	.75c lb. (A)	x
Zinc oxide and leaded zinc oxides containing not more than 25% lead:				
In any form of dry powder	1.75c lb.	x	.60c lb.	x
Ground in or mixed with oil or water	2.25c lb.	x	1.00c lb.	x
Lithopone:				
Less than 30% zinc sulfide	1.75c lb.	1.50c lb. (B)	.87½c lb.	x
30% or more zinc sulfide	1.75c lb. plus 15%	x	.87½c lb. plus 7½%	x
Zinc chloride	1.30c lb.	x	.75c lb.	.65c lb.
Zinc sulfate	.75c lb.	x	x	.30c lb.
Zinc sulfide	3.00c lb.	x	x	x

(A) duty suspended to June 30, 1953
(B) reduced by Netherlands agreement Feb. 1, 1936
x indicates no change in rate

It is to be noted that foreign ore smelted in bond pays no duty when the resulting slab zinc is exported. Alternatively, 99 per cent of the duty is refunded when products containing duty-paid slab zinc or zinc ore are shipped abroad.

On February 12, 1952, the duties on zinc ore and slab zinc were suspended. On March 31, 1953, they were restored as listed in Table XIII, column 4.

During September 1955, the State Department announced investigations and hearings with respect to certain items listed for consideration in proposed trade agreement negotiations.

Negotiations starting January 1956 in Geneva, Switzerland, were completed in May by twenty-two countries participating in a program for general agreement on tariffs and trade (Organization known as GATT).

Those results of that conference which exert influence on the zinc industry are indicated in Table XIV. Details may be found in Department of State publication 6348, Commercial Policy Series 158, June 1956. It is to be noted that the concessions are to be effected in three annual stages, with the first stage having been made effective June 30, 1956. It is also to be noted that zinc sulfide is one of the items affected by the recent GATT action, making obsolete the 3-cent per pound tariff indicated in Table XIII.

Table XIV

Tariff Par.	Sched. A No. (1956)	Schedule A Commodity Description	Rate of Duty			
				Geneva 1956 Agreement		
			Jan. 1, 1955	1st Stage June 30, 1956	2nd Stage June 30, 1957	3rd Stage June 30, 1958
93	8380.935	Zinc sulfide	3c lb.	2.8c lb.	2.7c lb.	2.5c lb.
341	9850.610	Electrotype, stereotype, halftone, photogravure, and photoengraved plates, and plates of other material than steel, engraved or otherwise prepared for printing, and lithographic plates of stone or other ma- of stone or other ma- or prepared.	12½% ad val	11½% ad val	11% ad val	10½% ad val
397	6559.900	Zinc manufactures, not plated with platinum, gold, or silver or gold lacquered, n.s.p.f.	22½% ad val	21% ad val	20% ad val	19% ad val

Salt Lake City, Utah
March 22, 1957

FILE MEMORANDUM

AMERICAN ZINC-LEAD SMELTING CO.
ZINC ORE RESERVES

During a recent meeting in San Francisco, a member of the above-mentioned firm advised me that their presently known reserves of zinc ores are sufficient to last them 100 years at their present rate of production. He stated also that they planned to gradually increase their production each year over the next four or five years.

F. V. Richard

F. V. RICHARD

FVR:bm
cc: S.D.Strauss
D.J.Pope
L.H.Hart

PREPRINT FROM

BUREAU OF MINES MINERALS YEARBOOK

1953

Zinc

BY O. M. BISHOP AND ESTHER B. MILLER

For sale by the Superintendent of Documents, U. S. Government Printing Office
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PROPERTY
OF
AMERICAN SMELTING AND REFINING COMPANY
WESTERN MINING DEPARTMENT
PACIFIC NATIONAL LIFE BUILDING
SALT LAKE CITY 1, UTAH

UNITED STATES DEPARTMENT OF THE INTERIOR • Douglas McKay, Secretary

BUREAU OF MINES • Thos. H. Miller, Deputy

This publication is a chapter from Volume I, MINERALS YEARBOOK, 1953. The complete volume, covering all mineral commodities, except fuels, may be purchased from the Superintendent of Documents, Washington 25, D. C., at a date to be announced later. Volume II (Mineral Fuels) and Volume III (Geographic Areas) also will be available from the Superintendent of Documents.

Zinc

By O. M. Bishop [1] and Esther B. Miller [2]

THE ZINC INDUSTRY of the United States in 1953 was characterized by record consumption of slab zinc, record imports, near record smelter output, and greatly reduced domestic mine production. Industry-held stocks of slab zinc at the year end were the greatest since 1945, and the average selling price of zinc was the lowest since 1947 despite general increases in the cost of production. Elsewhere, mine and smelter production was at higher levels than requirements, a fact that stimulated exports to the United States and accentuated the market problems of domestic miners. The supply of zinc, including newly mined, secondary recovery in all forms, and imports, totaled 1,510,000 tons, whereas that consumed as slab, ore, and secondary metal plus exports was about 1,370,000 tons.

During the year domestic zinc smelters produced 969,000 short tons of slab zinc, exceeding the 1952 output of 960,000 tons and establishing a new peacetime record. Of the 1953 output, 51 percent was from domestic ores, 43 percent from foreign ores, and 6 percent from scrap. Domestic mine production totaled 547,000 tons of recoverable zinc, 18 percent less than in 1952 and the smallest mine output since 1938. Most of the reduced output resulted from mine closings or production curtailments in the second half of the year, particularly in the Tri-State region, New Mexico, Idaho, Colorado, Nevada, Arizona, New Jersey, and the Upper Mississippi Valley region.

Montana, with 80,300 tons, was for the third successive year the chief producing State. Other leading producing States, ranked by output, were Idaho, New York, New Jersey, Tennessee, Colorado, Oklahoma, Washington, Utah, and Arizona.

Imports of zinc in ores and concentrates and imports of slab zinc were 513,000 and 235,000 tons, respectively, compared with 450,000 and 116,000 tons in 1952. Never before were such quantities of slab zinc imported, and only once (in 1943 during the height of World War II) were such quantities of zinc concentrates imported.

Consumption of slab zinc was 986,000 tons, exceeding the World War II peak of 889,000 and the previous alltime high of 967,000 tons in 1950. Stocks at primary and secondary smelters increased from 85,000 tons to 180,000 during the year, while stocks at consumers' plants or in transit thereto declined from about 101,000 tons to 92,000.

The market price of Prime Western zinc, East St. Louis, which was 12.5 cents a pound at the beginning of the year, advanced to 13.0 cents on January 2, but thereafter in 5 successive drops went to 11.0 cents by March 5, where it remained until September 2, when the price dropped to 10.5 cents. Subsequently, on September 11, the

[1] Commodity-industry analyst.
[2] Statistical assistant.

price was reduced to 10.0 cents, where it remained the rest of the year. The average price received by producers of slab zinc in 1953 was 11.5 cents a pound compared with 16.6 cents in 1952 and 18.2 cents in 1951.

Because of the widespread mine closings and reduced employment in the zinc- (and lead-) mining industry much thought was given to tariff revision through either new legislation or the invoking of the "escape clause" of the Reciprocal Trade Agreements Act, and various other proposals were made to restrict imports or provide other means of direct or indirect aid to the domestic industry. On July 29, 1953, the Tariff Commission, in response to resolutions of the United States Senate Committee on Finance and the House of Representatives Committee on Ways and Means, instituted a general investigation of the zinc and lead industries to determine relevant facts of production, trade, consumption, and competitive position, including the effect of imports of lead and zinc on the livelihood of American workers. The report of the investigation was published April 20, 1954.[3]

TABLE 1.—Salient statistics of the zinc industry in the United States, 1944–48 (average) and 1949–53

	1944–48 (average)	1949	1950	1951	1952	1953
Production of primary slab zinc:						
By sources:						
From domestic ores ..... short tons	509,753	591,454	588,291	621,826	575,828	495,436
From foreign ores ..... do	280,724	223,328	255,176	259,807	328,651	420,669
Total ..... do	790,477	814,782	843,467	881,633	904,479	916,105
By methods:						
Electrolytic ..... percent of total	37	40	41	38	39	40
Distilled ..... do	63	60	59	62	61	60
Production of redistilled secondary slab zinc ..... short tons	52,931	55,041	66,970	48,657	55,111	52,875
Stocks on hand at primary smelters Dec. 31 ..... short tons	149,895	90,710	7,948	21,343	81,344	176,675
Price:						
Prime Western at St. Louis:						
Average for period ..... cents per pound	9.86	12.15	13.88	17.99	16.21	10.86
Highest quotation ..... do	17.50	17.50	17.50	19.50	19.50	13.00
Lowest quotation ..... do	8.25	9.00	10.00	17.50	12.50	10.00
Yearly average at London ..... do	8.90	14.41	14.89	21.46	[1] 18.53	9.47
Mine production of recoverable zinc:[2] short tons	635,083	593,203	623,375	681,189	666,001	547,430
Tri-State district (Joplin) percent of total	21	13	13	13	14	10
Western States ..... do	51	60	59	58	58	56
Other ..... do	28	27	28	29	28	34
World smelter production of zinc short tons	1,681,000	[1]2,012,000	[1]2,172,000	[1]2,315,000	[1]2,425,000	2,557,000

[1] Revised figure.
[2] Includes Alaska.

GOVERNMENT REGULATIONS

Government price controls imposed January 26, 1951, under the General Ceiling Price Regulation were terminated February 12, 1953. The last Government control over domestic use—that requiring periodic reports on the quantity of slab zinc stocked and consumed—was revoked in June 1953. Export licenses continued to be required for exports to all countries but Canada.

[3] United States Tariff Commission, Lead and Zinc—Report on Investigation Conducted under Section 332 of the Tariff Act of 1930 Pursuant to a Resolution by the Committee on Finance of the United States Senate, dated July 27, 1953, and a Resolution by the Committee on Ways and Means, House of Representatives, dated July 29, 1953, April 1954, Parts I, II, III, IV and V.

GOVERNMENT PROGRAMS UNDER DEFENSE PRODUCTION ACT OF 1950

Provisions of the Defense Production Act of 1950 with respect to exploration were carried out by the Defense Minerals Exploration Administration (DMEA) and those with respect to procurement by the Defense Materials Procurement Agency (DMPA).

DEFENSE MINERALS EXPLORATION ADMINISTRATION

Exploration contracts and amendments to existing contracts continued to be made by the DMEA during 1953, but in conformance to a directive issued by the Office of Defense Mobilization no applica-

TABLE 2.—Defense Minerals Exploration Administration contracts involving lead and zinc, by States, executed in 1953

Contractor	County	Government maximum participation
ARIZONA		
Coronado Copper & Zinc Co	Cochise	$49,525.00
French, Gordon R	Pinal	9,750.00
Globe Miami Copper & Zinc Corp	Gila	31,875.00
Yuma Metals, Inc [1]	Yuma	37,500.00
COLORADO		
Blum, Robert F	Clear Creek	1,400.00
Burleson, S. E. and W. E	Saguache	13,300.00
Jones, Myron L., L. M. and Paul R. and Lill, E. M	Dolores	4,130.00
Mariposa Mining Co	San Miguel	10,600.00
Shenandoah-Dives Mining Co	San Juan	105,950.00
Vinson, Mike and Harris, Fred	Summit	18,800.00
IDAHO		
Bunker Hill & Sullivan Mining & Concentrating Co	Shoshone	549,375.00
Day Mines, Inc	do	121,430.00
Golconda Lead Mines	do	45,000.00
Idaho Custer Mines, Inc	Custer	48,868.00
North Fork Mining Co	Shoshone	22,250.00
Pierce, Roger V	Lemhi	31,850.00
Polaris Mining Co	Shoshone	342,977.50
Silver Buckle Mining Co	do	114,750.00
Spokane-Idaho Mining Co	do	71,317.00
MONTANA		
Golden Anchor Mining & Milling Co., Inc	Powell	17,358.00
Neuberg Bros. & Sloan, Inc	Jefferson	22,700.00
Pohl, E. E., Kleinschmidt, H. G., and A. R	Broadwater	6,000.00
NEVADA		
Bullock, Frank	Elko	10,350.00
Consolidated Eureka Mining Co	Eureka	28,525.00
UTAH		
Cleghorn, Willard	Utah	9,177.00
U. S. Smelting, Refining & Mining Co	Salt Lake	74,762.50
VIRGINIA		
Bellville Gold Mines, Ltd	Buckingham	14,125.00
WASHINGTON		
American Zinc, Lead & Smelting Co. Grandview Mines	Stevens	10,500.00
Do	do	18,200.00
Total		[2] 2,068,303.00

[1] Executed in 1952 but not previously listed.
[2] This sum exceeds the total of the listed contracts since it includes sums provided through amendments to contracts previously executed; also includes funds for participation in exploration contracts which were subsequently canceled or terminated upon completion.

tions were accepted for lead- and zinc-exploration projects after May 15, 1953. The turnabout in lead and zinc supplies from scarcity to plenty in the second half of 1952 and the continued accumulation of stocks in the United States, as well as abroad, in 1953 were considered determining factors in the decision reached by ODM.

The objective of the DMEA—to encourage exploration and increase reserves of strategic and critical minerals and metals, including lead and zinc—was achieved through projects to explore potential domestic ore sources. The Government financed up to 50 percent of the total cost of approved exploration projects for lead and zinc and during the calendar year 1953 entered into 30 contracts involving maximum Government participation of $2,068,303.[4] Through December 31, 1953, 193 lead- and zinc-exploration contracts had been executed, authorizing a maximum Government participation of $7,614,636. Lead-zinc or lead-zinc-copper exploration contracts in 1953 composed 17 percent of all DMEA contracts executed and 40 percent of the funds obligated; through 1953 they represented 32 percent of all contracts and 43 percent of the funds obligated.

DEFENSE MATERIALS PROCUREMENT AGENCY

The Defense Materials Procurement Agency program with respect to lead and zinc was greatly reduced in early 1953 as the supply-requirement ratio increased, and production-expansion programs put in force in 1951 and 1952 were coming to fruition. On August 14, 1953, the remaining function of DMPA—that of servicing contracts and completing those in negotiation—was given to the Emergency Procurement Service of General Services Administration.

Only one contract was approved in 1953 for development of a lead-zinc property in the United States; on June 29, 1953, a development contract with Chief Consolidated Mining Co., Salt Lake City, Utah, was executed. The Government advanced Chief Consolidated $283,373 or 25 percent of proposed expenditures for development of the company Chief No. 1 and Plutus mines in the Tintic district, Juab County, Utah. The contract was a percentage royalty agreement of 3 years duration; the loan was to be repaid on the basis of 5 percent of net smelter returns from ores developed under terms of the contract.

United States assistance in developing foreign zinc resources was negligible in 1953. Foreign Operations Administration, formerly Mutual Security Administration, continued to execute contracts, using counterpart funds, with several foreign companies; tonnages of zinc involved totaled only a few hundred tons, however.

DOMESTIC PRODUCTION

Statistics on zinc production are compiled on both a mine and smelter basis. The mine-output data, based upon the zinc content of ores shipped and concentrates produced (adjusted to account for average smelting losses), form an accurate measure of domestic zinc

[4] Includes sums provided through amendments to contracts previously executed; also includes funds for participation in exploration contracts subsequently canceled or terminated upon completion.

output from year to year. Smelter production of slab zinc from domestic ores represents a more accurate figure of zinc-metal recovery but differs from the mine-recovery figure because of a time lag between mine or mill shipments and smelter production and because considerable zinc concentrate is not smelted but rather is utilized directly in making zinc pigments and chemicals.

On April 20, 1954, the United States Tariff Commission released a 553-page report [5] based on its general investigation of the domestic lead and zinc industries and the competitive position of the industry with reference to foreign producers under existing tariff structures. The study, which was based in part on a canvass of domestic lead and zinc mining, milling, smelting, and refining companies, covered employment, wage rates, principal expenses, profit-and-loss experience, and grades and value of ores mined in 1952 and in some part for 1953, making comparisons where possible with figures established by the Census of Minerals for 1939.

One tabulation showed that in 1939 the lead-zinc mines of the United States produced 16,317,000 tons of crude ore with a recoverable metal content of 2.2 percent lead, 2.8 percent zinc, and 0.71 and 0.004 ounce per ton of silver and gold, respectively, utilizing 32,283,000 man-hours of labor at $0.62 per hour. The total value of mine or mill products for that year was $62,652,000. Another similar tabulation, prepared by the United States Tariff Commission from 211 reports covering 89 percent of the 1952 national output of recoverable lead and 90 percent of the recoverable zinc, showed a considerable change in the intervening 13-year period. The 211 reporting firms indicated that in 1952 they produced 22,919,000 tons of crude ore with a recoverable metal content of 1.4 percent lead, 2.5 percent zinc, 0.1 percent copper, and 0.73 and 0.006 ounce of silver and gold, respectively. Man-hours worked by production and related workers in mining and milling this tonnage totaled 43,791,000, paid at an average hourly rate of $1.95. The total mine or mill value of all products was $225,384,000.

On the basis of these figures, it is concluded that in the period 1939 to 1952 wages increased 215 percent, the tons of ore mined and milled per man-hour increased from 0.51 to 0.52, the grade of ores as indicated by the recovery of zinc and lead declined 11 and 36 percent, respectively, and the value of products sold per ton of crude ore increased from $3.84 to $9.83 or 156 percent. The quantity and value of products, principal expenses, hourly earnings, and man-hours worked in lead and zinc mining and milling in the United States are given by States or principal regions in table 3. Table 4 shows the crude ore sold or treated and the recoverable metal content by States, regions, and districts.

Wages, productivity per unit of labor, and grade of ore in 1953 essentially equaled those in 1952, but Bureau of Mines estimated the value of the mine products to have dropped about 31 percent to approximately $6.75 per ton. According to reports to the Tariff Commission which accounted for 92 percent of the mine output of lead and 93 percent of the zinc, the number of employees engaged in

[5] Work cited in footnote 3.

TABLE 3.—Lead and zinc mining and milling: Quantity and value of products, principal expenses, hourly earnings, and man-hours per unit of output in the United States, by principal regions or States in 1952 [1]

[Compiled by the U. S. Tariff Commission]

Item	By principal metal produced				United States total	By principal regions or States					
			All other			States east of the Mississippi River			West Central States		
	Predominantly lead [2]	Predominantly zinc [3]	Chiefly lead [4]	Chiefly zinc [5]		Total	Northern Illinois and Wisconsin	New York, New Jersey, Kentucky, Pennsylvania, Tennessee, and Virginia	Total	South-eastern Missouri	Tri-State (Oklahoma, Kansas, and Southwest Missouri)
Number of reports	30	71	47	63	211	22	13	9	46	3	43
Number of mines covered	38	125	67	83	313	33	16	17	103	8	95
Number of mills covered	10	38	25	40	113	17	8	9	24	6	18
Mine or mill value of all products [6] 1,000 dollars	37,029	78,869	41,108	68,378	225,384	38,071	7,290	30,781	61,105	35,625	25,480
Ratio of mine or mill value of products to gross market value of recoverable metals produced [7] percent	85.7	64.9	69.1	62.8	67.7	64.6	66.5	64.2	79.2	84.3	73.0
Recoverable metals produced:											
Lead short tons	124,835	34,235	99,636	87,653	346,359	8,089	3,177	4,912	143,598	122,222	21,376
Zinc do	3,744	334,945	53,979	203,517	596,185	173,515	30,573	142,942	89,539	3,602	85,937
Silver 1,000 fine ounces	398	777	7,910	7,403	16,488				327	327	
Gold fine ounces	189	3,249	31,195	94,903	129,536						
Copper short tons	1,083	1,800	1,946	8,117	12,946				1,082	1,082	
Principal expenses designated below, total 1,000 dollars	24,401	49,424	27,943	53,355	155,123	21,130	4,078	17,052	40,702	23,590	17,112
Salaries and wages, total do	14,492	29,758	19,621	35,796	99,667	12,940	2,430	10,510	23,640	13,883	9,757
Paid to production and related workers do	12,107	25,369	16,479	31,232	85,187	10,499	2,124	8,375	20,280	11,520	8,760
Paid to other employees do	2,385	4,389	3,142	4,564	14,480	2,441	306	2,135	3,360	2,363	997
Cost of supplies, materials, fuels, and purchased electric energy, total do	9,909	19,666	8,322	17,559	55,456	8,190	1,048	6,542	17,062	9,707	7,355
Supplies and materials do	7,977	16,855	6,788	15,022	46,642	7,257	1,186	6,071	13,870	7,820	6,050
Fuels do	104	377	269	402	1,152	143	108	35	280	81	199
Purchased electric energy do	1,828	2,434	1,265	2,135	7,662	790	354	436	2,912	1,806	1,106
Ratio of principal expenses to mine or mill value of products, total percent	65.9	62.7	68.0	78.0	68.8	55.5	55.9	55.4	66.6	66.2	67.2
Salaries and wages do	39.1	37.7	47.7	52.3	44.2	34.0	33.3	34.2	38.7	39.0	38.3
Supplies and materials do	21.6	21.4	16.5	22.0	20.7	19.0	16.3	19.7	22.7	21.9	23.8
Fuel do	.3	.5	.7	.6	.5	.4	1.5	.1	.4	.2	.8
Purchased electric energy do	4.9	3.1	3.1	3.1	3.4	2.1	4.8	1.4	4.8	5.1	4.3
Man-hours worked by production and related workers, total 1,000 man-hours	6,196	13,951	8,179	15,465	43,791	6,050	1,080	4,970	10,804	5,826	4,978
Per dollar's worth of products	.17	.18	.20	.23	.19	.16	.15	.16	.18	.16	.20
Average hourly earnings of production and related workers	1.95	1.82	2.01	2.02	1.95	1.74	1.97	1.69	1.88	1.98	1.76
Crude ore mined 1,000 short tons	6,037	9,921	2,113	4,848	22,919	3,889	1,145	2,744	11,697	5,987	5,710

Item	By principal regions or States—Continued									
	Western States									
	Total	Arizona	California	Colorado	Idaho	Montana	Nevada	New Mexico	Utah	Washington
Number of reports	143	21	6	26	22	16	16	13	16	7
Number of mines covered	177	24	6	40	32	16	16	14	20	9
Number of mills covered	72	8	4	11	20	5	4	10	5	5
Mine or mill value of all products [6] ... 1,000 dollars	126,208	9,786	4,196	19,342	28,981	20,180	3,896	10,308	23,404	6,115
Ratio of mine or mill value of products to gross market value of recoverable metals produced [7] ... percent	64.0	57.3	58.5	64.1	62.1	66.5	58.7	54.7	77.8	60.8
Recoverable metals produced:										
Lead ... short tons	194,672	10,959	10,575	25,322	63,866	14,850	5,475	5,711	46,314	11,600
Zinc ... do	333,131	31,866	8,171	50,365	66,050	64,289	12,693	49,944	30,699	19,054
Silver ... 1,000 fine ounces	16,161	1,011	921	2,102	4,500	3,310	537	360	3,371	49
Gold ... fine ounces	129,536	18,006	2,774	62,457	1,548	9,257	4,808	891	29,795	----------
Copper ... short tons	11,864	3,259	223	2,969	108	2,695	139	821	1,633	17
Principal expenses designated below, total ... 1,000 dollars	93,291	6,562	2,253	14,777	22,782	17,903	3,382	8,085	13,697	3,850
Salaries and wages, total ... do	63,087	4,474	1,498	8,597	16,400	12,752	2,339	5,242	9,420	2,365
Paid to production and related workers ... do	54,408	4,023	1,251	7,531	14,216	10,728	1,990	4,561	7,993	2,115
Paid to other employees ... do	8,679	451	247	1,066	2,184	2,024	349	681	1,427	250
Cost of supplies, materials, fuels, and purchased electric energy, total ... do	30,204	2,088	755	6,180	6,382	5,151	1,043	2,843	4,277	1,485
Supplies and materials ... do	25,515	1,791	634	5,685	5,289	4,346	824	2,141	3,456	1,349
Fuels ... do	729	119	52	53	234	132	15	29	69	26
Purchased electric energy ... do	3,960	178	69	442	859	673	204	673	752	110
Ratio of principal expenses to mine or mill value of products, total ... percent	73.9	67.0	53.7	76.4	78.6	88.7	86.8	78.4	58.5	63.0
Salaries and wages ... do	50.0	45.7	35.7	44.4	56.6	63.2	60.0	50.8	40.2	38.7
Supplies and materials ... do	20.2	18.3	15.1	29.4	18.2	21.5	21.1	20.8	14.8	22.1
Fuel ... do	.6	1.2	1.2	.3	.8	.7	.4	.3	.3	.4
Purchased electric energy ... do	3.1	1.8	1.7	2.3	3.0	3.3	5.3	6.5	3.2	.8
Man-hours worked by production and related workers, total ... 1,000 man-hours	26,937	2,079	615	4,111	6,689	5,043	1,085	2,259	4,042	1,014
Per dollar's worth of products	.21	.21	.15	.21	.23	.25	.28	.22	.17	.17
Average hourly earnings of production and related workers	2.02	1.94	2.03	1.83	2.13	2.13	1.83	2.02	1.98	2.09
Crude ore mined ... 1,000 short tons	7,333	461	158	1,246	1,760	1,414	250	620	683	741

See footnotes on page 8.

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[1] Represents data from 211 reports covering 313 mines and 113 mills that were engaged during any part of 1952 or 1953 in producing ores valued chiefly for their content of lead plus zinc. The mines covered produced 89 percent of the total 1952 production of recoverable lead and 90 percent of the total output of recoverable zinc from all mines including mines other than lead and zinc mines. Considering only the lead and zinc produced by all lead and zinc mines, the mines covered in this table accounted for 92 percent of the total lead and 93 percent of the total zinc.

[2] Based on reports covering mines producing ores in which the gross market value of the recoverable lead content was 75 percent or more of the total gross market value (at average market prices in 1952) of all recoverable metals contained.

[3] Based on reports covering mines producing ores in which the gross market value of the recoverable zinc content was 75 percent or more of the total gross market value (at average market prices in 1952) of all recoverable metals contained.

[4] Based on reports covering mines producing ores in which the gross market value of the recoverable lead content was greater than the gross market value (at average market prices in 1952) of the recoverable content of any other single metal.

[5] Based on reports covering mines producing ores in which the gross market value of the recoverable zinc content was greater than the gross market value (at average market prices in 1952) of the recoverable content of any other single metal.

[6] Represents value of ores or concentrates produced (and old tailings reclaimed) plus value added in milling (value of concentrates produced minus value of ores, including old tailings, milled).

[7] Gross market value of products used in this ratio was computed by multiplying the quantities of recoverable metals produced by the following average market prices of the refined metals: Lead $329.34 per ton; zinc $324.30 per ton; silver $0.905 per fine ounce; copper $484.00 per ton; and gold $35.00 per fine ounce.

TABLE 4.—Lead and zinc: Grade of ore mined in the United States in terms of recoverable metal content, by States, regions, or districts in 1952

[Compiled by the U. S. Tariff Commission from official statistics of the Bureau of Mines]

State, region, or district	Crude ore sold or treated	Recoverable metal content				
		Lead	Zinc	Silver	Gold	Copper
	Short tons	*Percent*	*Percent*	*Oz. per ton*	*Oz. per ton*	*Percent*
Western States:						
Arizona, total	811,856	1.8	4.1	2.00	0.030	1.0
Big Bug district	196,050	2.1	5.5	2.96	.088	.1
Old Hat district	92,995	3.9	3.5	.77	.009	.2
Warren (Bisbee) district	43,242	4.1	11.0	1.74	.014	.7
California, total	188,712	5.8	4.8	5.21	.020	.3
Coso (Darwin) district	127,235	6.1	4.3	5.63	.006	.1
Colorado, total	1,176,190	2.3	4.5	1.71	.054	.2
Upper San Miguel district	454,469	1.7	2.2	1.68	.077	.5
California (Leadville) district	192,316	2.7	4.4	1.58	.095	.1
Idaho, total	1,862,459	3.5	3.7	2.49	.001	(1)
Couer d'Alene region [2]	1,730,826	3.5	3.8	2.20	.001	(1)
Montana, total	2,350,507	.9	3.4	1.79	.006	.1
Summit Valley (Butte) district	2,264,596	.7	3.4	1.70	.005	.1
Nevada, total	303,498	2.2	5.0	2.27	.018	.1
New Mexico, total	721,005	1.0	7.1	.54	.002	.1
Central district	632,385	.7	7.6	.47	.001	.1
Utah, total [3]	674,825	7.1	4.8	4.85	.042	.2
West Mountain (Bingham) district	432,218	7.9	4.7	4.69	.033	.3
Park City district	62,062	6.8	5.5	5.16	.023	.1
Washington, total [4]	744,622	1.5	2.6	.08	(5)	(1)
Total, Western States [6]	8,834,440	2.4	4.1	2.02	.016	.2
West Central States:						
Southeastern Missouri	6,148,606	1.8	(1)	.08	--------	(1)
Tri-State (Kansas, Oklahoma and Southwestern Missouri)	6,140,155	.4	1.4	--------	--------	--------
Total, West Central States [7]	12,289,136	1.1	.7	.04	--------	(1)
States east of the Mississippi River:						
Upper Mississippi Valley district (Northern Illinois and Wisconsin)	1,216,655	.3	2.7	(8)	--------	--------
New York, New Jersey, Tennessee, and Virginia, total	2,719,385	.2	5.1	.01	--------	--------
Total, States east of the Mississippi River [9]	3,962,857	.2	4.5	.01	--------	--------
Grand total, United States	25,086,433	1.4	2.5	.73	.006	.1

[1] Less than 0.05 percent.

[2] Data presented at the Tariff Commission hearings indicated that the gross metal content of 1,185,000 tons of ore milled in the Coeur d'Alene district in 1952 was 4.7 percent lead, 5.2 percent zinc, and 2.7 ounces of silver per ton; the average gross metal content of 9,110,000 tons of ore milled during 1946 to mid-1953, inclusive, was 5.2 percent lead, 5.6 percent zinc, and 2.9 ounces of silver per ton.

[3] Data presented at the Tariff Commission hearings from records of the Utah State Tax Commission indicated that lead-zinc mines in that State in 1952 produced 796,592 tons of ore with a gross content of 6.9 percent lead and 5.6 percent zinc; lead-zinc mines in Utah produced 5,393,000 tons of ore during 1946–52 with an average gross lead content of 6.9 percent and an average gross zinc content of 5.6 percent.

[4] Data presented at the Tariff Commission hearings for the Metaline district, which accounts for the bulk of the lead and zinc production in Washington, indicated that the gross metal content of 595,000 tons of ore milled in 1952 was 1.6 percent lead and 2.7 percent zinc; the average gross metal content of 2,834,000 tons of ore milled during 1946 to mid-1953, inclusive, was 1.5 percent lead and 3.2 percent zinc.

[5] Less than 0.0005 ounce per ton.

[6] Including Oregon, South Dakota, and Texas, in addition to the States given above.

[7] Including Arkansas, in addition to the States given above.

[8] Less than 0.005 ounce per ton.

[9] Including Kentucky in addition to the States given above.

NOTE.—This tabulation includes all ores that are classified by the Bureau of Mines as "lead ores," "zinc ores," "lead-zinc ores," and "zinc-lead ores," in addition to such other classes of ores in which the value of the recoverable lead plus zinc content was greater than the value of the recoverable content of other metals. Some "lead-copper," "zinc-copper," and "zinc-lead-copper ores" were excluded because the value of their recoverable lead and zinc content was less than the value of their content of other metals. Old tailings and material from old slag dumps are not included. The mined ores included in this tabulation contained 357,909 tons of recoverable lead and 627,257 tons of recoverable zinc, or 91.7 and 94.2 percent, respectively, of the total United States output from all ores mined and from old tailings, and old slag dumps reclaimed.

mining and milling lead and zinc ores declined from 23,800 in January 1952 to 16,200 in October 1953, or 32 percent.

Employment at primary zinc smelters and refineries (exclusive of construction workers) declined about 3 percent between January 1952 and October 1953 and averaged 12,700 in 1952 and 12,600 for the first 10 months of 1953.

In studying the competitive position of the domestic lead-zinc mining industry, the Tariff Commission obtained reports from certain foreign producers which in 1952 accounted for 80 and 61 percent, respectively, of the lead and zinc mined in Canada, 28 and 45 percent of that mined in Mexico, and 68 percent of that mined in Australia. From these confidential reports the Commission concluded, with relation to Canada, the United States, and Mexico as follows:

> * * * That total principal operating expenses, as well as expenses for wages and salaries, are lower *per ton of crude ore* mined in the United States than in Canada and Mexico. This appears to be the case even though average hourly earnings of workers are much lower for operations in Mexico than for those in either Canada or the United States, and are slightly lower for Canada than for the United States. The data also indicate that taxes other than income taxes *per ton of crude ore* mined in Mexico were much higher than in Canada and very much higher than in the United States.
>
> However, when allowance is made for the differences in the average value of the ores mined in the three countries, as affected by differences in the yield of metals obtained from them, the situation with respect to the foregoing comparison of costs is quite different. Notwithstanding apparently higher operating expenses, and higher expenses for salaries and wages, *per ton of crude ore* mined in Canada and Mexico than in the United States, these expenses are lower *per unit of recoverable metal* in Mexico and Canada than in the United States.

MINE PRODUCTION

Domestic mine production of recoverable zinc (including that recovered as zinc pigments and salts directly from ore) decreased to 547,000 tons, the smallest output since 1938 and 18 percent less than the 666,000-ton mine output of 1952. The decline was the direct result of mine curtailments and closings following the succession of price drops, which between June 2, 1952, and September 11, 1953, amounted to 49 percent for zinc metal and about 59 percent for zinc concentrate.

The zinc mines of the United States are widely dispersed in more than 50 important mining districts, which occur in 7 areas—the Tri-State area of southeastern Kansas, southwestern Missouri, and northeastern Oklahoma; Tennessee-Virginia; Sussex County, N. J.; St. Lawrence County, N. Y.; northern Illinois and Wisconsin; southern Illinois and Kentucky; and the Western States (in order of 1953 output, Montana, Idaho, Colorado, Washington, Utah, Arizona, New Mexico, Nevada, and California.)

The Western States produced 304,000 tons or 21 percent less than in 1952, the West Central States produced 59,000 tons or 38 percent less, but the States East of the Mississippi River with 184,000 tons produced about the same as in 1951 and 1952. A brief summation of domestic mine production by States, major mines, and districts follows. Information in greater detail is to be found in the State chapters of volume III.

For the third consecutive year, Montana was the chief zinc-producing State, with 80,300 tons or 15 percent of the total. The Butte

mines (Summit Valley district) of the Anaconda Copper Co. and zinc recovered from the lead slags of the East Helena smelter supplied about 97 percent of the production. The remainder was derived from the Jack Waite and a few other mines.

Idaho, with an output of 72,200 tons, ranked second among the States. The Coeur d'Alene region, Shoshone County, supplied 95 percent of the State's zinc output, with the Star, Bunker Hill, Page, and Morning mines the major producers. The Triumph mine in Blaine County was also an important zinc producer.

Colorado, with 37,800 tons, ranked sixth among the States, but its output was 29 percent less than in 1952 because of mine closures. The most important producing mines, in order of output, were the Eagle, Treasury Tunnel-Black Bear, Resurrection, Smuggler Union, and Rico Argentine.

Washington increased its zinc production 63 percent as the new Van Stone mine in Stevens County completed its first full year of production. The Pend Oreille, Grandview, and Deep Creek mines were the other major producers.

Utah produced 29,200 tons of zinc in 1953, or 11 percent less than in 1952, largely because the Silver King Coalition mines and Park Utah Consolidated mines (Judge and Keetley) were inoperative throughout 1953. The United States and Lark mines, New Park, Chief Consolidated, and West Calumet were the chief mines, in order of output.

Arizona output declined 42 percent to 27,500 tons owing to the continued idleness of several producers that closed in 1952, plus some additional closings in 1953. The Iron King mine, Yavapai County, was the State's chief producing zinc mine, followed by the Trench property in Santa Cruz County and the Republic-Mammoth in Cochise County.

New Mexico ceased all zinc mine production about October 1; and that, with previous curtailments and closings, decreased output in 1953 by 74 percent to 13,400 tons. Major mines or mine groups producing in early 1953 were the Kearney, Ground Hog, Bayard, and Lynchburg.

Nevada and California zinc output in 1953 declined 62 and 43 percent, respectively, as several mines in each State were forced to curtail by low zinc prices.

Zinc production in the West Central States fell proportionately more than in the combined Western States as output in the major producing area—the Tri-State district—declined from the 91,000 tons of 1952 to 55,700 tons in 1953. Much of the decline resulted from a strike which closed the Eagle-Picher Co. Central mill from June 21 through the remainder of the year. Since mines that normally shipped to the Central mill were unable to have the ores treated, they, too, were forced to close. The leading zinc producers in the Tri-State district were Eagle-Picher Co. (Oklahoma and Kansas), American Zinc, Lead & Smelting Co. (Oklahoma and southwest Missouri), National Lead Co. (Kansas), Dale Mining Co. (southwest Missouri), and Beck Mining Co. (Oklahoma and Kansas). The lead mines of southeast Missouri produced 3,200 tons of recoverable zinc as a byproduct.

TABLE 5.—Mine production of recoverable zinc in the United States, 1944–48 (average) and 1949–53, by States in short tons

State	1944–48 (average)	1949	1950	1951	1952	1953
Western States and Alaska:						
Alaska	9	2	6	1		
Arizona	44,418	70,658	60,480	52,999	47,143	27,530
California	7,199	7,209	7,551	9,602	9,419	5,358
Colorado	39,157	47,703	45,776	55,714	53,203	37,809
Idaho	83,135	76,555	87,890	78,121	74,317	72,153
Montana	35,015	54,195	67,678	85,551	82,185	80,271
Nevada	20,413	20,443	21,606	17,443	15,357	5,812
New Mexico	42,546	29,346	29,263	45,419	50,975	13,373
Oregon		6	21	3	1	
South Dakota	21					
Texas	13			24	3	
Utah	37,216	40,670	31,678	34,317	32,947	29,184
Washington	12,273	10,740	14,807	18,189	20,102	32,786
Total	321,415	357,527	366,756	397,383	385,652	304,276
West Central States:						
Arkansas	91	1	8	50	26	
Kansas	47,375	29,433	27,176	28,904	25,482	15,515
Missouri	20,914	5,911	8,189	11,476	13,986	9,981
Oklahoma	65,037	44,033	46,739	53,450	54,916	33,413
Total	133,417	79,378	82,112	93,880	94,410	58,909
States east of the Mississippi River:						
Illinois	9,485	18,157	26,982	21,776	18,816	14,556
Kentucky	397	935	731	3,457	3,280	489
New Jersey	75,867	50,984	55,029	62,917	59,190	45,700
New York	32,343	37,973	38,321	40,051	32,636	51,529
Tennessee	32,001	29,788	35,326	38,639	38,020	38,465
Virginia	17,063	13,166	12,396	7,332	13,409	16,676
Wisconsin	13,095	5,295	5,722	15,754	20,588	16,830
Total	180,251	156,298	174,507	189,926	185,939	184,245
Grand total	635,083	593,203	623,375	681,189	666,001	547,430

The States east of the Mississippi River produced 184,200 tons to maintain approximately their 1951–52 rate of production. New York, New Jersey, and Tennessee were respectively third, fourth, and fifth among the States in 1953. Zinc output in New York increased 58 percent and was the greatest in the State's history, exceeding the previous record year, 1943, by 12 percent. New Jersey produced 45,700 tons in 1953, a 23-percent decrease from 1952 and 40 percent less than the 1944–48 average.

The principal zinc-producing companies in this group of States were the New Jersey Zinc Co. (Franklin and Sterling Hill mines in New Jersey and Austinville mine in Virginia); St. Joseph Lead Co.

(Balmat and Edwards mines in New York); the American Zinc Co. of Tennessee (Athletic—closed in October, Grasselli, Jarnagin—closed in March, Mascot No. 2, and North Friends Station, all in Tennessee); United States Steel Corp., Tennessee Coal & Iron Division (Davis-Bible group mines in Tennessee); Tennessee Copper Co. (in Tennessee); the Vinegar Hill Zinc Co., Tri-State Zinc, Inc., Calumet & Hecla, Inc., and Eagle-Picher Co. (in northern Illinois and Wisconsin); and the Minerva Oil Co., and Ozark-Mahoning Co. (in southern Illinois and western Kentucky).

The 25 leading zinc-producing mines in the United States in 1953, listed in table 7, yielded 72 percent of the total domestic zinc output; the 3 leading mines 30 percent; and the 6 leading mines 40 percent.

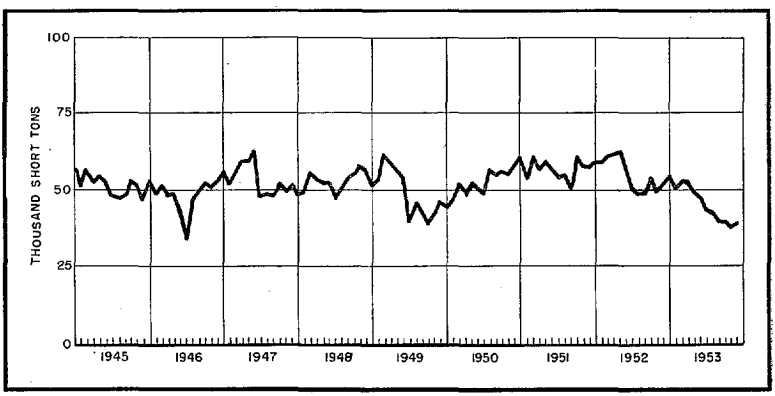

FIGURE 1.—Mine production of recoverable zinc in the United States, 1945–53, by months, in short tons.

TABLE 6.—Mine production of recoverable zinc in the United States,[1] 1952–53, by months, in short tons

Month	1952	1953	Month	1952	1953
January	59,377	54,034	August	49,209	41,677
February	59,145	50,356	September	49,291	39,893
March	60,972	52,726	October	54,243	39,635
April	61,354	52,119	November	49,782	37,699
May	62,751	48,840	December	52,263	39,919
June	57,079	47,310			
July	50,535	43,222	Total	666,001	547,430

[1] Includes Alaska.

TABLE 7.—Twenty-five leading zinc-producing mines in the United States in 1953, in order of output

Rank	Mine	District	State	Operator	Type of ore
1	Butte Hill Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Zinc-lead.
2	Franklin and Sterling Hill	New Jersey	New Jersey	New Jersey Zinc Co	Zinc.
3	Balmat	St. Lawrence County	New York	St. Joseph Lead Co	Zinc-lead.
4	United States and Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co	Do.
5	Star	Hunter	Idaho	Sullivan Mining Co	Do.
6	Eagle Group	Red Cliff (Battle Mountain)	Colorado	Empire Zinc Division, New Jersey Zinc Co	Zinc.
7	Austinville	Austinville	Virginia	New Jersey Zinc Co	Zinc-lead.
8	Davis-Bible Group	Eastern Tennessee	Tennessee	United States Steel Corp., Tennessee Coal & Iron Division.	Zinc.
9	Lawyers Group	Tri-State	Oklahoma	American Zinc, Lead & Smelting Co	Zinc-lead.
10	Mascot No. 2	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Zinc.
11	Page	Yreka	Idaho	American Smelting & Refining Co	Zinc-lead.
12	Pend Oreille	Metaline	Washington	Pend Oreille Mines & Metals Co	Do.
13	Iron King	Big Bug	Arizona	Shattuck Denn Mining Corp	Do.
14	Van Stone	Northport	Washington	American Smelting & Refining Co	Zinc.
15	Edwards	St. Lawrence County	New York	St. Joseph Lead Co	Do.
16	Bayard Group	Central	New Mexico	U. S. Smelting, Refining & Mining Co	Do.
17	Calumet	Wisconsin	Wisconsin	Calumet & Hecla, Inc	Do.
18	Bunker Hill and Sullivan	Yreka	Idaho	Bunker Hill & Sullivan Mining & Concentrating Co	Zinc-lead.
19	Old slag dump	Yreka	do	do	Zinc-bearing slags.
20	Treasury Tunnel	Upper San Miguel	Colorado	Idarado Mining Co	Copper-zinc-lead.
21	Morning	Hunter	Idaho	American Smelting & Refining Co	Zinc-lead.
22	Grandview	Metaline	Washington	American Zinc, Lead & Smelting Co	Do.
23	Bautsch	Northern Illinois	Illinois	Tri-State Zinc Co., Inc	Zinc.
24	Grasselli	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Do.
25	Ballard	Tri-State	Kansas	National Lead Co., St. Louis Smelting & Refining Division.	Zinc-lead.

TABLE 8.—Mine production of zinc in the United States in the principal districts [1] of the United States, 1944–48 (average) and 1949–53, in terms of recoverable zinc, in short tons

District	State	1944–48 (average)	1949	1950	1951	1952	1953
Summit Valley (Butte)	Montana	23,337	47,982	63,511	80,500	75,968	75,170
Coeur d'Alene	Idaho	78,748	74,370	86,103	74,989	70,316	68,650
Tri-State (Joplin region)	Kansas, Southwestern Missouri, Oklahoma.	132,552	78,628	80,558	91,553	90,512	55,729
St. Lawrence County	New York	32,343	37,973	38,321	40,051	32,636	51,529
New Jersey	New Jersey	75,867	50,984	55,029	62,917	59,190	45,700
Eastern Tennessee [2]	Tennessee	32,001	29,788	35,326	38,639	38,020	38,465
Upper Mississippi Valley	Northern Illinois, Iowa,[3] Wisconsin.	17,208	17,846	26,793	31,403	34,716	26,286
West Mountain (Bingham)	Utah	16,787	22,311	16,120	18,286	20,395	19,669
Red Cliff	Colorado	17,293	17,450	19,956	29,200	26,000	16,850
Austinville	Virginia	16,766	13,166	[2] 12,396	[2] 7,332	13,409	16,676
Central	New Mexico	37,293	26,376	26,897	41,884	48,043	12,743
Big Bug	Arizona	4,955	8,798	10,416	9,688	10,862	10,476
Upper San Miguel	Colorado	1,960	6,004	8,881	9,228	9,811	10,414
Kentucky-Southern Illinois	Kentucky, Southern Illinois.	5,768	6,541	6,642	9,584	7,968	5,589
Park City region	Utah	9,429	8,359	7,425	10,209	7,746	4,848
Harshaw	Arizona	1,945	2,947	4,193	4,076	3,924	4,186
California (Leadville)	Colorado	6,387	6,455	7,392	8,144	8,487	3,945
Cochise	Arizona	2,048	1,760	1,025	3,243	4,266	3,893
Warm Springs	Idaho	2,659	1,635	1,236	1,860	2,142	3,026
Smelter (Lewis and Clark County).	Montana	6,404	1,463	2,358	2,428	2,807	2,924
Pioneer (Rico)	Colorado	3,705	1,354	1,365	2,527	2,734	2,634
Eureka (Bagdad)	Arizona	712	2,304	1,478	2,504	3,520	2,594
Tintic	Utah	3,547	6,082	5,985	3,410	2,951	2,433
Aravaipa	Arizona	382	783	921	1,404	1,315	1,732
Rush Valley and Smelter (Tooele County).	Utah	5,901	2,188	1,219	1,608	916	1,528
Silver Bell	Arizona	46	1	11	--------	364	1,324
Breckenridge	Colorado	720	362	427	366	620	1,200
Warren (Bisbee)	Arizona	21,747	35,393	20,707	4,511	4,791	1,182
Verde (Jerome)	do	92	4,350	7,800	10,155	4,360	959
Creede	Colorado	22	671	873	892	1,024	858
Animas	do	1,004	1,029	961	1,183	986	541
Magdalena	New Mexico	4,172	2,263	1,677	2,276	2,122	512
Patagonia (Duquesne)	Arizona	688	555	368	601	1,049	257
Pima (Sierritas, Papago, Twin Buttes).	do	4,660	7,177	5,802	5,414	3,472	11
Chelan Lake [4] [5]	Washington	1,902	2,724	2,430	1,879	(6)	(6)
Coso [5]	California	1,501	4,062	5,237	4,720	5,479	(6)
Flint Creek [5]	Montana	63	8	120	392	1,084	(6)
Metaline [5]	Washington	8,091	6,496	11,032	12,753	(6)	(6)
Northport [5]	do	2,139	1,412	1,304	3,496	(6)	(6)
Ophir [5]	Utah	440	1,004	374	341	670	(6)
Pioche [5]	Nevada	16,659	18,651	19,655	14,350	12,493	(6)
Sneffels [5]	Colorado	477	1,053	810	1,094	931	(6)
Cow Creek (Ingot)	California	36	(6)	(6)	(6)	(6)	--------
Heddleston	Montana	1,568	2,026	892	1,395	1,066	--------
Old Hat (Oracle)	Arizona	3,746	5,195	4,603	3,583	3,368	--------
Pioneer (Superior)	do	1,229	--------	2,595	6,240	4,175	--------
Smelter (Cascade County) [5]	Montana	--------	1,278	--------	--------	--------	--------
Ten Mile	Colorado	4,208	9,716	2,925	16	12	--------
Tomichi	do	994	1,456	963	1,011	874	--------
Yellow Pine (Goodsprings)	Nevada	702	447	643	1,332	1,464	--------

[1] Districts producing 1,000 short tons or more in any year of the period 1949–53.
[2] Includes very small quantity produced elsewhere in State.
[3] No production in Iowa since 1917.
[4] Includes Peshastin Creek and Wenatchee River districts.
[5] This district is not listed in order of 1953 output.
[6] Quantity withheld to avoid disclosure of individual company operations.

SMELTER PRODUCTION

During 1953, 18 primary zinc-reduction plants were operating; 9 operated with horizontal retorts exclusively, 4 with vertical retorts exclusively (1 wholly electrothermic and 1 partly so), and 5 with electrolytic methods.

Horizontal-Retort Plants.—The total number of retorts reported at active horizontal-retort primary plants in 1953 was 55,900 compared with 55,800 retorts reported in 1952. Of the total retorts reported, 38,800 (69 percent) were in use at the end of 1953 compared with 51,800 (93 percent) in use at the close of 1952. There were no additional retorts under construction at the end of 1953.

Vertical-Retort Plants.—Four vertical-retort, continuous distilling plants operated during 1953. Three of these used the New Jersey Zinc Co. externally gas-fired vertical retorts and the fourth used the St. Joseph Lead Co. electrothermically heated vertical retort, in which the charge is the resistor. The New Jersey Zinc Co. continued to use its Sterling arc-type electric furnace, which was first put in operation experimentally in 1951. The total number of vertical retorts of all types at the end of 1953, as at the beginning of the year, was 91. Of this number, 71 were in operation at the end of the year.

Electrolytic Plants.—Five electrolytic zinc-reduction plants with a total of 3,692 electrolytic cells were operated in 1953; 3,464 cells were in use at the end of the year. Comparable 1952 figures were 3,370 cells, of which 3,340 cells were operating at the end of that year.

Smelting Capacity.—Irrespective of additions or subtractions of smelter recovery units, statistics on domestic smelting capacity may vary from year to year, owing to changes in metallurgical practices at the various plants. According to reports to the Bureau of Mines, the active zinc-reduction plants in the United States as of the end of 1953 had a reported annual capacity of 1,147,000 tons of slab zinc. This figure indicates that smelter output was 84 percent of capacity. In 1952 smelter production was 86 percent of the reported capacity of 1,112,000 tons. Horizontal and vertical retort plants operated at 83 percent of the 677,000 tons reported capacity (84 percent of a 680,000-ton capacity in 1952), electrolytic plants at 90 percent of a 412,500-ton reported capacity (94 percent of 375,000-ton capacity in 1952), and secondary smelters at 61 percent of 58,000-ton reported capacity (64 percent of 57,000-ton capacity in 1952).

Waelz Kilns.—The following companies operated Waelz kilns in 1953:

Arkansas: Fort Smith—The Residue Co.
Illinois:
- Danville—The Hegeler Zinc Co.
- Fairmont City—American Zinc Co. of Illinois.
- La Salle—Matthiessen & Hegeler Zinc Co.

Kansas: Cherryvale—National Zinc Co., Inc.
Oklahoma: Henryetta—Eagle-Picher Co.
Pennsylvania:
- Donora—American Steel & Wire Division, United States Steel Corp.
- Palmerton—New Jersey Zinc Co.

Slag-Fuming Plants.—The following companies operated slag-fuming plants in 1953 to produce impure zinc oxide, which was further treated to recover the zinc as slab zinc:

California: Selby—American Smelting & Refining Co.
Idaho: Kellogg—Bunker Hill & Sullivan Mining and Concentrating Co.
Montana: East Helena—Anaconda Copper Mining Co.
Texas: El Paso—American Smelting & Refining Co.
Utah: Tooele—International Smelting & Refining Co.

During 1953 these 5 plants treated 656,600 tons of hot and cold slag, which yielded 113,800 tons of oxide fume containing 79,200 tons of recoverable zinc. Corresponding figures for 1952 were 626,200, 104,200, and 73,300 tons, respectively. The new slag-fuming plant[6] at the Selby smelter, which began operation April 20, 1953, was described in the technical press. The plant has capacity to recover 10,000 tons of zinc from lead slags annually.

Active Zinc-Reduction Plants.—During 1953 the Sullivan Mining Co. continued construction of new facilities at its Kellogg, Idaho, plant. These included a second thawing shed for frozen concentrate, 18 concrete storage bins having capacity for 18,000 tons of concentrate, and a pretreatment plant for removing magnesia and lime from concentrates obtained from Metaline Falls, Wash. A new sulfuric acid plant with 250- to 300-ton daily capacity was scheduled for completion in January 1954. Early in 1953 the Kellogg smelter resumed capacity operation following a period of power curtailment, but output was again curtailed 20 percent in April for lack of concentrates. By June the concentrate shortage was overcome, and operations returned to normal. The Henryetta, Okla., smelter of the Eagle-Picher Co. was closed by a strike in early November which continued through the remainder of the year. Other curtailments included an 18-percent reduction in output at St. Joseph Lead Co., Josephtown, Pa., plant announced November 6; a 20-percent reduction at the Fort Smith, Ark., smelter of the Athletic Mining & Smelting Co. in March; and 2 cutbacks of 1,000 tons each, on October 1 and November 1, at the Fairmont City, Ill., smelter and a cutback of one-third at the La Salle, Ill., smelter of the Matthiessen & Hegeler Zinc Co.

A list of zinc-reduction plants operating in the United States in 1953 follows:

Primary Zinc Distillers

Horizontal-retort plants

Arkansas: Fort Smith—Athletic Mining & Smelting Co.
Illinois:
- Fairmont City—American Zinc Co. of Illinois.
- La Salle—Matthiessen & Hegeler Zinc Co.

Oklahoma:
- Bartlesville—National Zinc Co., Inc.
- Blackwell—Blackwell Zinc Co.
- Henryetta—Eagle-Picher Co.

Pennsylvania: Donora—American Steel & Wire Division, United States Steel Corp.
Texas:
- Amarillo—American Smelting & Refining Co.
- Dumas—American Zinc Co. of Illinois.

Vertical-retort plants

Illinois: Depue—The New Jersey Zinc Co.
Pennsylvania:
- Josephtown—St. Joseph Lead Co.
- Palmerton—The New Jersey Zinc Co. of Pennsylvania.

West Virginia: Meadowbrook—Matthiessen & Hegeler Zinc Co.

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[6] Engineering and Mining Journal, Slag-Fuming at Selby: Vol. 154, No. 12, December 1953, pp. 95-97.

Electrolytic plants

Idaho: Kellogg—Sullivan Mining Co.
Illinois: Monsanto—American Zinc Co. of Illinois.
Montana:
Anaconda—Anaconda Copper Mining Co.
Great Falls—Anaconda Copper Mining Co.
Texas: Corpus Christi—American Smelting & Refining Co.

Secondary Zinc Smelters.—Zinc-base scrap, a term that includes skimmings and drosses, die-cast alloys, old zinc, engravers' plates, new clippings, and chemical residues, is chiefly smelted at 12 secondary smelters, although 33 percent is reduced at primary smelters, and much of the sal ammoniac skimmings are processed at chemical plants.

The primary and secondary smelting operations based on zinc-base scrap produced 52,900 tons of redistilled zinc, 6,100 tons of remelt zinc, 25,300 tons of zinc dust, and 11,400 tons of zinc in zinc oxide form, as well as remelt die-cast slab, and zinc pigments and salts.

In addition to secondary zinc and zinc products recovered from zinc-base scrap at primary and secondary smelters and other plants, 161,000 tons of zinc were recovered from copper-base scrap, chiefly in the form of brass and bronze. Additional details of the secondary zinc phase of the industry may be obtained from the Secondary Metals—Nonferrous chapter of this volume.

Secondary Zinc Distillers

Alabama: Fairfield—W. J. Bullock, Inc.
California:
Los Angeles—American Smelting & Refining Co., Federated Metals Division.
Torrance—Pacific Smelting Co.
Illinois:
Beckemeyer—American Smelting & Refining Co., Federated Metals Division.
Hillsboro—American Zinc, Lead & Smelting Co.
Sandoval—Sandoval Zinc Co.
New Jersey: Trenton—American Smelting & Refining Co., Federated Metals Division.
New York: Tottenville—Nassau Smelting & Refining Co.
Oklahoma: Sand Springs—American Smelting & Refining Co., Federated Metals Division.
Pennsylvania:
Bristol—Superior Zinc Corp.
Philadelphia—General Smelting Co.
West Virginia: Wheeling—Wheeling Steel Corp.

SLAB ZINC

The output of primary slab zinc during 1953 was 916,000 tons, an increase of only 1 percent over the 1952 production and the highest output of primary zinc since 1943. Slab zinc from domestic ores declined 14 percent compared with 1952, but that from foreign ores increased 28 percent.

Production of redistilled slab zinc declined 4 percent to 53,000 tons. Of this total, 33 percent (18,000 tons) was produced at primary smelters and 67 percent (35,000 tons) at secondary smelters.

In addition to primary distilled zinc and redistilled secondary zinc, 2,900 tons of remelted secondary slab zinc was recovered by remelting purchased scrap (3,200 tons in 1952). Zinc rolling mills and other large consumers of slab zinc recovered large quantities of slab zinc

from scrap generated in their own plants, but metal so recovered is not measured statistically.

Of the primary slab zinc produced in 1953, 60 percent was distilled and 40 percent produced electrolytically.

Production of Special High Grade, Brass Special, and Prime Western grades increased during 1953, but output of all other grades declined. Of the total 1953 production (comparable 1952 figures in parentheses), 42 (42) percent was Prime Western, 32 (31) percent Special High Grade, 19 (19) percent High Grade, 6 (5) percent Brass Special, 1 (2) percent Intermediate, and less than 0.5 percent (1) Select.

TABLE 9.—Primary and redistilled secondary slab zinc produced in the United States, 1944–48 (average) and 1949–53, in short tons

Year	Primary			Redistilled secondary	Total (excludes zinc recovered by remelting)
	From domestic ores	From foreign ores	Total		
1944–48 (average)	509,753	280,724	790,477	52,931	843,408
1949	591,454	223,328	814,782	55,041	869,823
1950	588,291	255,176	843,467	66,970	910,437
1951	621,826	259,807	881,633	48,657	930,290
1952	575,828	[1] 328,651	904,479	55,111	959,590
1953	[1] 495,436	[1] 420,669	916,105	52,875	968,980

[1] Includes a small tonnage of slab zinc further refined into high-grade metal.

TABLE 10.—Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1944–48 (average) and 1949–53, in short tons

CLASSIFIED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled	Redistilled secondary [1]		Total
			At primary smelters	At secondary smelters	
1944–48 (average)	295,321	495,156	22,890	30,041	843,408
1949	326,152	488,630	22,782	32,259	869,823
1950	342,085	501,382	28,411	38,559	910,437
1951	336,087	545,546	16,251	32,406	930,290
1952	351,106	553,373	18,861	36,250	959,590
1953	370,870	545,235	17,645	35,230	968,980

CLASSIFIED ACCORDING TO GRADE

Year	Grade A		Grade B (Intermediate)	Grades C and D		Grade E (Prime Western)	Total
	Special High Grade (99.99% Zn)	High Grade (Ordinary)		Brass Special	Select		
1944–48 (average)	239,051	202,102	42,607	62,498	14,605	282,545	843,408
1949	230,576	206,651	21,513	56,388	2,565	352,130	869,823
1950	271,678	192,075	21,571	46,730	4,021	374,362	910,437
1951	281,571	175,499	20,734	60,511	13,494	378,481	930,290
1952	295,801	182,125	17,903	48,817	13,608	401,336	959,590
1953	312,810	180,188	14,720	56,219	1,930	403,113	968,980

[1] For total production of secondary zinc see chapter on Secondary Metals—Nonferrous.

TABLE 11.—Primary slab zinc produced in the United States, by States where smelted, 1944–48 (average) and 1949–53, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Texas and West Virginia [1]	Total	
								Short tons	Value
1944–48 (average)	22,441	37,674	118,138	199,095	116,769	190,127	106,233	790,477	$158,481,977
1949	17,116	41,854	86,823	216,578	157,650	156,920	137,841	814,782	202,391,849
1950	20,688	53,922	108,301	216,104	145,117	162,539	136,796	843,467	240,050,708
1951	21,776	54,468	108,544	208,482	161,247	189,177	137,939	881,633	321,619,718
1952	21,644	54,340	115,331	214,980	161,242	193,811	143,131	904,479	300,829,715
1953	20,379	54,037	129,904	222,354	134,918	192,279	162,234	916,105	210,154,487

[1] Includes Missouri, 1943–44 and 1947–53.

Montana maintained its position as the largest producer of primary slab zinc in 1953. Pennsylvania and Oklahoma were second and third in rank, respectively. All slab zinc produced in Montana and Idaho was produced electrolytically, that in Illinois and Texas was in part electrolytic and in part distilled, but that produced in all other States was wholly by distillation.

BYPRODUCT SULFURIC ACID

Sulfuric acid is made from sulfur dioxide gases produced in roasting zinc blende (sphalerite) concentrate at all zinc smelters where there is enough demand for sulfuric acid to warrant the plant investment and operation. At several such plants large quantities of elemental sulfur are also burned to increase acidmaking capacity. The production of sulfuric acid at such plants from 1949 through 1953 is shown in table 12.

TABLE 12.—Sulfuric acid (basis, 100 percent) made at zinc blende roasting plants in the United States, 1944–48 (average) and 1949–53

Year	Made from zinc blende [1]		Made from native sulfur		Total [1]		
						Value [1]	
	Short tons	Value [2]	Short tons	Value [2]	Short tons	Total [2]	Average per ton
1944–48 (average)	587,130	$7,722,128	219,358	$2,901,515	806,488	$10,623,643	$10.23
1949	476,932	7,276,481	130,592	1,992,423	607,524	9,268,904	11.85
1950	609,571	8,829,236	243,743	3,530,464	853,314	12,359,700	11.25
1951	635,948	10,218,400	261,106	4,195,451	897,054	14,413,851	12.48
1952	664,714	11,031,494	224,671	3,728,613	889,385	14,760,107	12.89
1953	636,864	11,397,458	229,951	4,115,262	866,815	15,512,720	13.90

[1] Includes acid from foreign blende.
[2] At average of sales of 60° B. acid.

ZINC DUST

Production of zinc dust in 1953 was 25,300 tons compared with 25,100 tons in 1952. The zinc dust reported here is restricted to commercial grades that comply with close specifications as to percentage of unoxidized metal, evenness of grading, and fineness of particles and hence does not include zinc powder and blue powder. The zinc content of the dust produced in 1953 ranged from 95.0 percent to

99.7 and averaged 97.7 percent. Shipments of zinc dust were 24,600 tons, of which 500 tons was for foreign consignees. Producers' stocks of zinc dust rose from 1,400 tons at the beginning of the year to 1,900 tons at the end of 1953.

The average price of all zinc dust shipped in 1953 was 13.3 cents a pound compared with 19.5 cents in 1952. Most of the production is from zinc scrap (principally galvanizers' dross), but some is recovered from zinc ore and as a byproduct of zinc refining. The secondary raw materials used to manufacture zinc dust are reviewed in the Secondary Metals—Nonferrous chapter of this volume.

TABLE 13.—Zinc dust [1] produced in the United States, 1944–48 (average) and 1949–53

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per pound			Total	Average per pound
1944–48 (average)	28,756	$6,866,817	$0.119	1951	31,695	$13,438,680	$0.212
1949	22,776	6,195,072	.136	1952	25,113	9,794,070	.195
1950	28,922	9,602,104	.166	1953	25,297	6,546,344	.133

[1] All produced by distillation.

ZINC PIGMENTS AND SALTS

The principal zinc pigments are zinc oxide and lithopone and the principal salts the chloride and sulfate. These products are manufactured from various zinc-bearing materials, including ore, metal, scrap, and residues. In all, 176,000 tons of zinc was consumed in these products, of which 118,000 tons were derived from ore (foreign, 39,000 tons), 21,000 tons from slab zinc, and 37,000 tons from secondary materials. Details of the production of zinc pigments and salts are given in the Lead and Zinc Pigments and Zinc Salts chapter of this volume.

CONSUMPTION AND USES

According to reports from approximately 750 plants, 986,000 tons of slab zinc was consumed in 1953, compared with 853,000 tons in 1952 and 967,000 tons in the previous record year of 1950. Slab zinc received at consumers' plants totaled 980,000 tons. In comparing the year's consumption with that of 1952 it must be remembered that the 1952 consumption was reduced by the steel shortage resulting from the nationwide steel strike June 2 to July 25, 1952, and that part of 1953 consumption was to fulfill consumer requirements that were necessarily deferred in 1952.

Galvanizing continued to be the largest field of zinc use, using 407,000 tons or 41 percent of the total slab zinc consumed and 8 percent more than in 1952. Gains were noted in the galvanizing of sheet and strip and in job galvanizing. Two new continuous-strip galvanizing lines were erected at steel plants, bringing the total of such plants to 18 at the year end, with 5 more under construction. The manufacture of zinc-base alloys (chiefly die castings) required

307,000 tons of zinc or 30 percent more than in 1952, owing largely to a 32-percent increase in the 1953 output of automobiles and trucks over that in 1952. Slab zinc consumed in brassmaking increased 15 percent to 178,000 tons, the highest since 1945. In addition to the slab zinc consumed in brassmaking in 1953, 161,000 tons of secondary zinc in the form of copper-base scrap was consumed in making brass and bronze ingots at secondary smelters.

TABLE 14.—Consumption of slab zinc in the United States, 1944–48 (average) and 1949–53, by industries, in short tons [1]

Industry and product	1944–48 (average)	1949	1950	1951	1952	1953
Galvanizing: [2]						
Sheet and strip	120,818	146,923	188,406	144,329	145,875	164,601
Wire and wire rope	46,746	39,231	47,317	51,792	48,645	44,100
Tubes and pipe	67,041	78,030	91,877	79,221	82,043	88,428
Fittings	11,845	11,487	15,948	21,186	10,366	10,330
Other	94,595	75,209	98,138	103,751	90,759	99,529
Total galvanizing	341,045	350,880	441,686	400,279	377,688	406,988
Brass products:						
Sheet, strip, and plate	112,185	43,157	68,737	67,815	71,706	94,826
Rod and wire	51,677	23,651	43,413	46,056	49,831	47,312
Tube	19,957	12,816	17,385	15,927	17,057	18,136
Castings and billets	8,361	2,620	4,170	7,098	7,262	8,145
Copper-base ingots	8,458	2,701	4,081	5,743	8,223	7,659
Other copper-base products	1,741	589	1,587	653	1,529	2,104
Total brass products	202,379	85,534	139,373	143,292	155,608	178,182
Zinc-base alloy:						
Die castings	169,123	199,665	285,022	282,812	225,877	297,280
Alloy dies and rod	5,763	2,024	2,929	11,135	9,235	7,140
Slush and sand castings	447	492	1,576	2,487	1,577	3,025
Total zinc-base alloy	175,333	202,181	289,527	296,434	236,689	307,445
Rolled zinc	82,772	55,200	68,444	64,085	51,318	54,649
Zinc oxide	18,303	10,292	18,187	18,223	17,205	20,675
Other uses:						
Wet batteries	1,686	1,359	1,527	1,749	1,396	1,417
Desilverizing lead	2,254	2,448	2,947	2,186	2,370	2,425
Light-metal alloys	1,158	1,060	1,356	3,132	3,266	5,939
Other [3]	4,325	2,887	4,087	4,591	7,243	8,207
Total other uses	9,423	7,754	9,917	11,658	14,275	17,988
Total consumption [4]	829,255	711,841	967,134	933,971	852,783	985,927

[1] Excludes some small consumers.
[2] Includes zinc used in electrogalvanizing and electroplating, but excludes sherardizing.
[3] Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.
[4] Includes 2,394 tons of remelt zinc in 1949, 3,035 tons in 1950, 4,505 tons in 1951, 4,144 tons in 1952, and 3,710 tons in 1953.

Slab zinc consumed in rolled-zinc products in 1953 increased 6 percent to 54,600 tons. In addition to slab zinc, the rolling mills remelt and reroll the metallic scrap (home scrap) produced from associated fabricating operations. The scrap so treated totaled 13,100 tons compared with 11,100 tons in 1952. Purchased zinc scrap, in the form of zinc clippings, old zinc scrap, and engravers' plates, totaling 3,600 tons was melted and rolled in 1953 (3,200 tons in 1952). Production of rolled zinc from both slab zinc and purchased scrap was 56,400 tons or 5 percent higher than the 1952 total of 53,500 tons. Stocks of rolled zinc were 1,700 tons at the end of 1953. In addition to shipments of 38,000 tons of rolled zinc in 1953 the rolling mills processed 32,000 tons

TABLE 15.—Rolled zinc produced and quantity available for consumption in the United States, 1952–53

	1952			1953		
	Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound
Production:						
Sheet zinc not over 0.1 inch thick	11,906	$7,210,737	$0.303	13,411	$7,416,190	$0.276
Boiler plate and sheets over 0.1 inch thick	1,387	705,111	.254	1,014	473,375	.233
Strip and ribbon zinc [1]	38,750	16,728,827	.216	40,603	14,433,514	.178
Foil, rod, and wire	1,441	905,477	.314	1,359	679,475	.250
Total rolled zinc	53,484	25,550,152	.239	56,387	23,002,554	.204
Imports	47	23,557	.251	196	76,507	.195
Exports	3,031	1,935,410	.319	3,239	1,696,142	.262
Available for consumption	50,688			53,469		
Value of slab zinc (all grades)			.166			.115
Value added by rolling			.073			.089

[1] Figures represent net production. In addition 11,107 tons of strip and ribbon zinc in 1952 and 13,113 tons in 1953 were rerolled from scrap originating in fabricating plants operated in connection with zinc rolling mills.

of rolled zinc in manufacturing 19,400 tons of semifabricated and finished products.

Table 16 shows the six commercial grades of refined slab zinc and purchased remelt zinc consumed by the various industries in 1953. Of the 986,000 tons of domestic and foreign slab zinc consumed, 39 percent was Prime Western, 38 percent Special High Grade, 14 percent High Grade, and 6 percent Brass Special. All grades were used in galvanizing, Prime Western mainly in hot-dip galvanizing and the higher grades for electrogalvanizing. Of the 178,000 tons of zinc used in brass products, 78 percent was Special High Grade and High Grade, as rigid specifications in brass manufacture dictate the use of high-grade metal.

TABLE 16.—Consumption of slab zinc in the United States in 1953, by grade and industry, in short tons

Industry	Special High Grade	High Grade	Intermediate	Brass Special	Select	Prime Western	Remelt	Total
Galvanizing	14,702	16,527	8,388	15,338	105	350,008	1,920	406,988
Brass products	40,789	98,349	1,894	8,452	3,664	24,160	874	178,182
Zinc-base alloy	305,155	923	220	38	27	840	242	307,445
Rolled zinc	8,854	20,307	10,361	14,261	47	819		54,649
Zinc oxide	7			16,154		4,514		20,675
Other	5,769	1,510	644	941		8,450	674	17,988
Total	375,276	137,616	21,507	55,184	3,843	388,791	3,710	985,927

CONSUMPTION OF SLAB ZINC BY GEOGRAPHIC AREAS

Data on slab zinc consumption, broken down by States and groups of States, have been published by the Bureau of Mines [7] for the years

[7] For 1940–45, see Bureau of Mines Inf. Circ. 7450, 1948, 30 pp. For more recent years see the Bureau of Mines Yearbooks, beginning with that for 1948.

1940 through the current year to give information by which patterns of consumption on an industry and geographic basis may be compared. The distribution of slab-zinc consumption by geographic divisions and by major use categories for recent years is shown in tables 17–22.

Consumption of Slab Zinc for All Uses.—The greatest concentration of slab-zinc consumption, by geographic divisions, was in the region comprising Illinois, Indiana, Michigan, Ohio, and Wisconsin. This area, which has consistently ranked first since before 1940, has used approximately half of the slab zinc consumed in the United States each year. The region of least consumption is the Mountain States group, made up of Arizona, Colorado, Idaho, Montana, and Utah, which used only 0.3 percent of the total. Ohio, which held second place among the 42 zinc-consuming States and the District Columbia from 1945 through 1951, was the leading consuming State in both 1952 and 1953, displacing Illinois, which had held first position from 1940 through 1951. Pennsylvania has held either second or third place since 1940. Connecticut was the second largest consuming State during World War II, when zinc for brassmaking was in greatly expanded demand. From 1945 through 1952 it occupied fourth position but during 1953 dropped to sixth place, being exceeded by both Indiana and Michigan.

TABLE 17.—Consumption of slab zinc in the United States, 1946–50 (average) and 1951–53, by geographic divisions and States [1]

Geographic division and State	1946–50 (average)		1951		1952		1953	
	Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
I. New England:								
Connecticut	59,821	5	69,926	4	65,350	4	73,197	6
Massachusetts	9,982	15	9,745	15	9,872	15	9,395	15
Maine	108	31	95	35	(2)	35	(2)	34
New Hampshire	13	36	(2)	37	(2)	39	(2)	38
Rhode Island	248	29	(2)	28	(2)	28	610	30
Total	70,172	3	80,348	3	75,984	3	83,476	3
II. Middle Atlantic:								
New Jersey	20,889	12	21,517	12	22,975	12	27,565	10
New York	46,442	6	57,809	6	52,738	7	67,081	7
Pennsylvania	123,527	3	137,056	3	126,083	3	135,850	3
Total	190,858	2	216,382	2	201,796	2	230,496	2
III. South Atlantic:								
Delaware			(2)	31	(2)	32	(2)	28
District of Columbia	28	34	(2)	36	(2)	37	(2)	37
Florida	6	37	(2)	33	(2)	33	(2)	33
Georgia	2,300	19	1,689	23	1,479	24	1,556	24
Maryland	25,571	9	28,878	9	29,077	9	36,850	9
North Carolina					(2)	38		
South Carolina	45	33			(2)	36	(2)	35
Viginia	247	30	273	32	373	31	702	29
West Virginia	24,540	10	25,616	10	23,655	10	21,340	12
Total	52,737	4	57,032	4	55,350	4	61,810	4
IV. East North Central:								
Illinois	152,504	1	167,937	1	142,516	2	157,765	2
Indiana	60,617	4	58,191	5	53,444	6	74,329	4
Michigan	44,126	7	55,864	7	53,491	5	73,241	5
Ohio	133,562	2	158,685	2	143,350	1	165,062	1
Wisconsin	12,114	14	13,951	14	12,057	14	13,859	14
Total	402,923	1	454,628	1	404,858	1	484,256	1

See footnotes at end of table.

TABLE 17.—Consumption of slab zinc in the United States, 1946–50 (average and 1951–53, by geographic divisions and States [1]—Continued

Geographic division and State	1946–50 (average)		1951		1952		1953	
	Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
V. East South Central:								
Alabama	23,815	11	25,502	11	23,241	11	25,420	11
Kentucky	8,564	16	(2)	16	(2)	16	8,291	16
Tennessee	1,272	23	(2)	25	(2)	25	1,865	23
Total	33,651	5	35,206	6	32,600	6	35,576	6
VI. West North Central:								
Iowa	6,086	17	4,480	18	4,632	18	5,452	18
Kansas	84	32	(2)	30	(2)	30	(2)	32
Minnesota	3,541	18	3,798	19	(2)	19	3,005	19
Missouri	16,447	13	19,472	13	14,734	13	14,858	13
Nebraska	1,473	22	(2)	24	(2)	23	(2)	25
Total	27,631	7	29,517	7	24,208	7	25,363	7
VII. West South Central:								
Arkansas	------	------	(2)	39	(2)	41	(2)	40
Louisiana	295	28	(2)	27	(2)	26	(2)	26
Oklahoma	912	25	(2)	22	1,921	22	2,229	22
Texas	2,110	20	4,959	17	5,230	17	6,641	17
Total	3,317	8	7,885	8	8,075	8	9,936	8
VIII. Mountain:								
Arizona	------	------	(2)	34	(2)	34	(2)	36
Colorado	1,741	21	(2)	21	(2)	20	2,250	21
Idaho	355	26	(2)	29	(2)	29	(2)	31
Montana	------	------	------	------	(2)	42	------	------
Utah	17	35	(2)	38	(2)	40	(2)	39
Total	2,113	9	3,038	9	2,880	9	2,844	9
IX. Pacific:								
California	28,894	8	41,898	8	39,955	8	45,104	8
Oregon	309	27	1,051	26	767	27	835	27
Washington	1,046	24	2,481	20	2,166	21	2,521	20
Total	30,249	6	45,430	5	42,888	5	48,460	5
Grand total [1]	813,651	------	929,466	------	848,639	------	982,217	------

[1] Excludes remelt zinc and some small consumers of slab zinc.
[2] Nominal quantity consumed included with subtotal for division, as less than 3 companies reported.

Consumption of Slab Zinc for Galvanizing.—The iron and steel industry is the largest consumer of slab zinc, using it to galvanize or coat steel sheets, wire, tube, pipe, cable, chain, bolts, railway-signal equipment, building and poleline hardware, and numerous other items. Fabricators of sheet steel and job galvanizers also use quantities of zinc in zinc coating numerous products. Zinc consumed in coating sheet and strip increased 13 percent in 1953 to 164,600 tons, a quantity exceeded only in 1950. Two additional continuous galvanizing lines were put in operation during 1953, and at the end of the year the rated capacity of the 18 such plants in operation and 5 under construction equaled 75 percent of the demand for quality zinc-coated sheets and strips (coils). Shipments of glavanized-steel sheets, reported by the American Iron and Steel Institute in 1953, totaled 2,291,000 tons compared with 1,961,000 tons in 1952 and 1,985,000 tons in 1951. The principal iron- and steel-producing States are also the principal consumers of zinc for galvanizing. From 1940 to 1943 Pennsylvania ranked first among the 34 States con-

suming zinc for galvanizing, but in 1944 Ohio displaced Pennsylvania and through 1953 has held first place. Ohio, Pennsylvania, Illinois, and Indiana used 62 percent of the slab zinc consumed for galvanizing in the period 1946 through 1950 and 58, 59, and 58 percent, respectively, in 1951, 1952, and 1953.

TABLE 18.—Consumption of slab zinc for galvanizing in the United States 1946–50 (average) and 1951–53, by States [1]

State	Geographic division	1946–50 (average)		1951		1952		1953	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	23,554	6	24,827	6	22,495	8	24,524	7
California	IX	16,214	8	23,756	8	22,516	7	27,116	6
Colorado	VIII	1,684	20	(2)	19	(2)	19	(2)	20
Connecticut	I	3,040	16	3,241	17	2,936	17	3,001	16
Florida	III	6	33	(2)	28	(2)	27	(2)	27
Georgia	III	2,294	18	(2)	22	(2)	22	(2)	22
Illinois	IV	45,523	3	46,510	3	46,633	3	46,605	3
Indiana	IV	27,794	4	31,570	4	30,865	4	35,196	5
Iowa	VI	67	30	294	27	268	28	242	30
Kentucky	V	8,562	9	7,945	9	7,852	9	7,854	9
Louisiana	VII	295	25	(2)	24	(2)	23	(2)	24
Maine	I	105	29	(2)	31	(2)	31	(2)	29
Maryland	III	25,037	5	28,486	5	28,656	5	36,261	4
Massachusetts	I	5,527	11	5,530	13	4,923	13	4,703	14
Michigan	IV	3,628	14	6,481	12	(2)	12	6,810	10
Minnesota	VI	3,541	15	(2)	16	2,939	16	2,944	17
Missouri	VI	4,021	13	6,720	10	3,598	15	4,234	15
Nebraska	VI	241	27	(2)	26	(2)	26	528	26
New Hampshire	I	3	34	------	------	------	------	------	------
New Jersey	II	4,857	12	5,519	14	5,354	11	6,041	12
New York	II	5,762	10	6,649	11	6,292	10	6,356	11
Ohio	IV	82,244	1	79,149	1	77,967	1	83,772	1
Oklahoma	VII	912	23	(2)	20	(2)	20	(2)	19
Oregon	IX	302	24	238	29	238	30	197	31
Pennsylvania	II	71,049	2	73,559	2	65,747	2	67,829	2
Rhode Island	I	242	26	(2)	25	(2)	25	(2)	25
South Carolina	III	44	32	------	------	(2)	32	(2)	32
Tennessee	V	1,014	21	941	23	736	24	1,305	23
Texas	VII	1,981	19	4,431	15	4,413	14	5,170	13
Utah	VIII	58	31	------	------	------	------	------	------
Virginia	III	165	28	(2)	30	(2)	29	(2)	28
Washington	IX	917	22	(2)	21	1,689	21	1,908	21
West Virginia	III	23,394	7	24,701	7	23,260	6	21,069	8
Wisconsin	IV	2,503	17	3,155	18	(2)	18	2,897	18
Total [1]	------	366,580	------	[3] 397,790	------	[3] 375,129	------	[3] 405,068	------

[1] Excludes remelt zinc. Includes zinc used in electrogalvanizing and electroplating, but excludes sherardizing.
[2] Quantity withheld to avoid disclosure of individual company operations.
[3] Includes States not individually shown (footnote reference 2).

Consumption of Slab Zinc for Brass Products.—Slab zinc consumed in brass products during 1953 increased 14 percent to 177,300 tons, the largest quantity since 1945 but well below the annual average of 294,800 tons of zinc used for brassmaking in the war years 1940–45. The concentration of brassmaking facilities in the Connecticut Valley has placed Connecticut first among the States in consuming slab zinc for that use, a position held long before the compilation of detailed statistics and one that it has continued to hold by a wide margin from 1940 through 1953. Michigan was in second place from 1940 through 1942 and again in 1946 and 1947. Wisconsin was in second place in 1943, but in 1944 and 1945 and from 1948 through 1953 Illinois held that position. Third place was held by New York in 1940 through

TABLE 19.—Consumption of slab zinc for brass products in the United States, 1946–50 (average) and 1951–53, by States [1]

State	Geographic division	1946–50 (average)		1951		1952		1953	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	222	13	(2)	12	(2)	12	(2)	12
California	IX	871	11	1,927	11	3,509	11	3,067	11
Colorado	VIII	56	15	(2)	17	(2)	15	(2)	16
Connecticut	I	50,309	1	60,055	1	56,704	1	63,127	1
Delaware	III			(2)	15	(2)	14	(2)	14
District of Columbia	III	28	17	(2)	18	(2)	22	(2)	24
Georgia	III	6	22	(2)	26	(2)	25	(2)	25
Illinois	IV	13,616	2	16,460	2	19,173	2	23,944	2
Indiana	IV	2,314	10	4,232	9	7,232	7	13,347	4
Iowa	VI	1	28	(2)	28				
Kansas	VI	37	16	(2)	23	(2)	18	(2)	20
Kentucky	V	2	25	(2)	16	(2)	16	(2)	19
Maine	I	2	26	(2)	29	(2)	30	(2)	29
Maryland	III	534	12	(2)	13	(2)	13	(2)	13
Massachusetts	I	2,901	9	2,973	10	3,724	10	3,504	10
Michigan	IV	12,475	3	14,649	3	17,869	3	19,259	3
Minnesota	VI					(2)	27	(2)	23
Missouri	VI	96	14	43	19	80	19	(2)	15
Nebraska	VI	2	27					(2)	30
New Hampshire	I	10	20	(2)	21	(2)	24	(2)	27
New Jersey	II	5,586	7	5,666	8	6,721	8	6,652	9
New York	II	8,891	4	9,390	5	11,100	4	12,655	6
Ohio	IV	8,609	5	10,831	4	10,339	5	13,013	5
Oregon	IX	6	23	(2)	25	(2)	23	(2)	22
Pennsylvania	II	5,438	8	6,483	7	(2)	6	(2)	7
Rhode Island	I	6	24	(2)	24	(2)	29	(2)	26
South Carolina	III	1	29						
Tennessee	V			(2)	20	(2)	28	(2)	31
Texas	VII	19	19	(2)	22	(2)	20	(2)	21
Utah	VIII	1	30	(2)	30	(2)	31	(2)	32
Virginia	III	23	18	(2)	27	(2)	26	(2)	17
Washington	IX	7	21			(2)	21	(2)	28
West Virginia	III			(2)	14	(2)	17	(2)	18
Wisconsin	IV	6,467	6	7,461	6	6,519	9	7,305	8
Total [1]		118,536		[3] 142,360		[3] 155,090		[3] 177,308	

[1] Excludes remelt zinc.
[2] Quantity withheld to avoid disclosure of individual company operations.
[3] Includes States not individually shown (footnote reference 2).

1942, by Ohio in 1943, Illinois in 1946 and 1947, and by Michigan all other years through 1953.

Consumption of Slab Zinc for Zinc-Base Alloys.—Slab zinc consumed in zinc-base alloys established a record of 307,200 tons, exceeding 1952 consumption by 30 percent and the previous record year (1950) by 6 percent. The automobile industry uses large quantities of zinc-base alloys for zinc die-cast parts and assemblies, such as fuel pumps, carburetors, radiator grilles, windshield-wiper motors, and much interior and exterior hardware. Passenger-car and truck production in 1953 totaled 7,300,000 units, a quantity exceeded only in 1950, when 8,400,000 units was produced. Not only did demand increase as a result of the requirements of the automobile and automobile-accessory industries, but requirements also rose for zinc die castings in home appliances; office machines, scientific, communications, and photographic equipment; and builders' hardware. Table 20 shows the quantities of zinc consumed in zinc-base alloys by States and the relative rank of each State. Illinois, Indiana, Michigan, Ohio, and Wisconsin, which are the principal producers of automotive parts and many home appliances, consumed over 62 percent of the slab zinc used in zinc-base alloys.

TABLE 20.—Consumption of slab zinc for zinc-base alloys in the United States, 1946–50 (average) and 1951–53, by States [1]

State	Geographic division	1946–50 (average)		1951		1952		1953	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	10	15						
California	IX	11,454	8	15,693	6	13,411	6	14,399	7
Colorado	VIII			(2)	16	(2)	16		
Connecticut	I	5,095	10	5,044	10	4,400	10	5,737	10
Delaware	III							(2)	15
Illinois	IV	55,687	1	72,740	1	48,944	2	60,613	2
Indiana	IV	14,348	6	11,740	8	8,840	9	15,476	6
Iowa	VI							(2)	17
Kansas	VI	29	13	312	14	(2)	14	(2)	14
Kentucky	V			(2)	15	(2)	15	(2)	16
Massachusetts	I	11	14	(2)	17	(2)	19	(2)	19
Michigan	IV	27,925	3	34,333	4	30,197	3	46,977	3
Missouri	VI	12,016	7	12,254	7	10,478	7	9,499	9
New Jersey	II	8,609	9	8,448	9	9,622	8	13,531	8
New York	II	26,581	4	35,825	3	29,990	4	41,620	4
North Carolina	III					(2)	18		
Ohio	IV	42,417	2	63,321	2	54,623	1	67,094	1
Oregon	IX			(2)	12	(2)	13	(2)	13
Pennsylvania	II	23,069	5	25,774	5	20,838	5	25,615	5
Texas	VII	109	12	(2)	13	(2)	12	(2)	12
Virginia	III	10	16	(2)	18	(2)	17	(2)	18
Washington	IX	7	17						
Wisconsin	IV	3,144	11	3,335	11	(2)	11	(2)	11
Total [1]		230,521		[3] 295,421		[3] 236,147		[3] 307,203	

[1] Excludes remelt zinc.
[2] Quantities withheld to avoid disclosure of individual company operations.
[3] Includes States not individually shown (footnote reference 2).

Consumption of Slab Zinc for Rolled Zinc.—Slab zinc consumed for rolled zinc has continued in the same geographic pattern from 1940 through 1953, but the quantity rolled has ranged from 49,000 tons in 1943 to 98,000 in 1945. During the war years 1940–45, the annual average consumption of slab zinc in this use was 70,000 tons; in the postwar years 1946–49 it averaged 74,000 tons and in 1950–53, 60,000 tons. In 1953 zinc-rolling mills reported the consumption of 54,600 tons of slab zinc in making sheet, strip ribbon, foil, rod, and wire. Illinois ranked first, with 23,000 tons, followed in order by Indiana, Pennsylvania, and New York.

TABLE 21.—Consumption of slab zinc for rolled zinc in the United States, 1946–50 (average) and 1951–53, by States

State	Geographic division	1946–50 (average)		1951		1952		1953	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Connecticut	I	1,155	7	(1)	6	(1)	7	(1)	7
Illinois	IV	35,833	1	31,471	1	25,353	1	23,066	1
Indiana	IV	15,411	2	(1)	3	(1)	3	(1)	2
Iowa	VI	5,993	4	(1)	5	(1)	5	(1)	5
Massachusetts	I	1,522	6	(1)	7	(1)	6	(1)	6
New York	II	4,772	5	(1)	4	(1)	4	(1)	4
Pennsylvania	II	6,857	3	(1)	2	(1)	2	(1)	3
West Virginia	III	1,136	8	(1)	8	(1)	8	(1)	8
Total		72,679		64,085		51,318		54,649	

[1] Quantity withheld to avoid disclosure of individual company operations.

Consumption of Slab Zinc for Other Uses.—The distribution, by States, of the quantity of slab zinc consumed in slush castings, wet batteries, desilverizing lead, light-metal alloys, zinc dust, chemicals, bronze powders, zinc oxide, and part of the zinc used for cathodic protection is shown in table 22. The increase in yearly totals, beginning with 1952, is due in large measure to inclusion of slab zinc consumed for zinc oxide.

TABLE 22.—Consumption of slab zinc for other uses in the United States, 1946–50 (average) and 1951–53, by States [1]

State	Geographic division	1946–50 (average)		1951		1952 [2]		1953 [2]	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	30	15	(3)	27	(3)	25	(3)	25
Arizona	VIII			(3)	17	(3)	16	(3)	19
Arkansas	VII			(3)	26	(3)	26	(3)	28
California	IX	354	6	522	5	519	7	522	12
Colorado	VIII	1	22			(3)	29	(3)	27
Connecticut	I	223	10	(3)	13	(3)	15	(3)	14
Idaho	VIII	356	5	(3)	9	(3)	10	(3)	11
Illinois	IV	94	14	(3)	6	2,413	2	3,537	2
Indiana	IV	98	13	276	14	(3)	14	(3)	13
Iowa	VI	24	16	(3)	16	(3)	8	(3)	8
Kansas	VI	18	18	(3)	21	(3)	27	(3)	22
Louisiana	VII			(3)	25	(3)	30	(3)	23
Maryland	III			(3)	20	(3)	20	(3)	18
Massachusetts	I	21	17	9	23	(3)	18	(3)	20
Michigan	IV	99	12	401	11	(3)	13	(3)	15
Minnesota	VI			(3)	28	(3)	28	(3)	29
Missouri	VI	315	7	455	7	578	6	(3)	7
Montana	VIII					(3)	31		
Nebraska	VI	1,230	3	(3)	3	(3)	4	(3)	6
New Jersey	II	1,838	2	1,884	2	1,278	3	1,341	3
New York	II	436	4	(3)	4	(3)	5	(3)	4
Ohio	IV	292	8	384	12	421	11	1,183	5
Oklahoma	VII			(3)	22	(3)	24	(3)	30
Oregon	IX					(3)	21	(3)	24
Pennsylvania	II	3,193	1	3,240	1	20,770	1	24,863	1
Tennessee	V	258	9	(3)	10	(3)	9	(3)	10
Texas	VII			(3)	19	(3)	19	(3)	17
Utah	VIII	6	20	(3)	24	(3)	22	(3)	26
Virginia	III	2	21	(3)	18	(3)	17	(3)	16
Washington	IX	115	11	(3)	8	(3)	12	(3)	9
West Virginia	III	10	19	(3)	15				
Wisconsin	IV					(3)	23	(3)	21
Total [1]		9,013		[4] 11,587		[4] 30,955		[4] 37,989	

[1] Excludes remelt zinc.
[2] Includes slab zinc used for zinc oxide.
[3] Quantity withheld to avoid disclosure of individual company operations.
[4] Includes States not individually shown (footnote reference 3).

STOCKS

National Strategic Stockpile.—The semiannual Stockpile Report to the Congress for July–December 1953 made no announcements relative to the zinc Stockpile objective or the rate of procurement in 1953, but trade sources and the Tariff Commission indicated that purchases were continued under authority of Public Law 520 of the 79th Congress.

Producers' Stocks.—Slab-zinc stocks on hand at producers' plants at the end of 1953 totaled 180,000 tons, the highest since 1945 and an increase of 95,000 tons over ending stocks in 1952. Average year-

end inventories for 1940–52 were 97,000 tons and ranged from a high of 256,000 tons in 1945 to a low of 9,000 tons in 1950.

TABLE 23.—Stocks of zinc at zinc-reduction plants in the United States at end of year, 1949–53, in short tons

	1949	1950	1951	1952	1953
At primary reduction plants	90,710	7,948	21,343	81,344	176,675
At secondary distilling plants	3,511	936	637	3,677	3,268
Total	94,221	8,884	21,980	85,021	179,943

Consumers' Stocks.—Slab-zinc stocks held by consumers on December 31, 1953 totaled 86,000 tons, a 7-percent decrease from the beginning of the year. This supply, together with 5,000 tons of metal in transit to consumers' plants, represented about 5 weeks' consumption at the average rate established in 1953.

TABLE 24.—Consumers' stocks of slab zinc at plants at the beginning and end of 1953, by industries, in short tons

Date	Galvanizers	Brass mills [1]	Die casters [2]	Zinc rolling mills	Oxide plants	Others	Total
Dec. 31, 1952	[3] 46,151	[3] 18,409	[3] 20,571	[3] 4,837	353	[3] 1,953	[3] [4] 92,274
Dec. 31, 1953	43,569	14,791	20,628	4,634	472	1,903	[4] 86,047

[1] Includes brass mills, brass-ingot makers, and foundries.
[2] Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy rods.
[3] Revised figure.
[4] Stocks on Dec. 31, 1952 and 1953, exclude 583 tons (revised figure) and 475 tons, respectively, of remelt spelter.

PRICES

The market price of Prime Western grade slab zinc, East St. Louis, was 12.5 cents a pound at the beginning of the year and advanced to 13 cents on January 2 but thereafter declined to 12.5 cents on January 14, 12 cents on January 27, 11.5 cents on February 3, 11.25 cents on February 25, and 11 cents on March 5. The 11-cent price remained in effect until July 16. Between July 16 and September 2 the price varied somewhat, owing to efforts to establish a delivered price, but, effective September 2, quotations were reestablished on the f. o. b. East St. Louis basis at 10.5 cents a pound. On September 11 the price dropped to 10 cents a pound at which level it remained for the balance of the year. Thus in a 16-month period starting in June 1952 the price of zinc dropped from 19.5 cents a pound to 10 cents, the widest fluctuation in so short a period since 1916.

The traditional East St. Louis basing-point system for pricing slab zinc was overturned in July, when the American Smelting & Refining Co. announced a series of new prices on a delivered basis. Two prices were established—1 for customers east of the Continental Divide and 1, a quarter of a cent higher, for customers west of the Divide. This pricing system had the effect of lowering the cost of metal to consumers in the East and on the Pacific coast, as formerly sales were made on the basis of East St. Louis delivery, with freight from that

TABLE 25.—Price of zinc concentrates and zinc, 1949–53

	1949	1950	1951	1952	1953
Joplin 60-percent zinc concentrates: [1] Price per short ton dollars	72.28	87.39	120.00	116.10	64.65
Average price common zinc at—					
St. Louis (spot)[1] cents per pound	12.15	13.88	17.99	16.21	10.86
New York [1] do	12.86	14.60	18.75	17.03	11.53
London [2] do	14.41	14.89	21.46	[3] 18.53	9.47
Price indexes (1947–49 average=100):					
Zinc (New York)	101	115	148	134	91
Lead (New York)	96	83	109	103	84
Copper (New York)	93	103	117	117	138
Straits tin (New York)	108	104	139	131	104
Nonferrous metals [4]	99	104	124	124	125
All commodities [4]	99	103	115	112	110

[1] Metal Statistics, 1954.
[2] *E&MJ Metal and Mineral Markets English quotations converted into American money on basis of* average rates of exchange recorded by Federal Reserve Board.
[3] Revised figure.
[4] Based upon price indexes of U. S. Department of Labor.

point to the consumer's plant paid by the buyer. The new system was abandoned in September owing to difficulties with ore contracts and with differentials on some of the higher grades of zinc. Sellers who had adopted the delivered basis for sales went back to the East St. Louis basing-point system on a slightly modified basis—purchasers to be charged freight but no more than one-half cent a pound.

The London Metal Exchange resumed dealings in zinc on January 2, marking the first time the free zinc market has functioned in Great Britain since August 31, 1939. The price on December 31, 1952,

TABLE 26—Average monthly quoted prices of 60-percent zinc concentrates at Joplin, and of common zinc (prompt delivery or spot) St. Louis and London 1952–53 [1]

Month	1952			1953		
	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 [2] [3]		St. Louis	London [2] [4]
January	135.00	19.50	23.56	85.44	12.60	11.21
February	135.00	19.50	23.56	72.08	11.48	10.35
March	135.00	19.50	23.75	67.46	11.03	9.98
April	135.00	19.50	23.75	65.00	11.00	8.99
May	135.00	19.50	22.75	65.00	11.00	8.70
June	109.20	15.74	17.01	65.00	11.00	8.93
July	100.00	15.00	16.12	65.00	11.00	9.24
August	95.96	14.07	15.25	65.00	11.00	9.19
September	94.42	14.00	15.26	57.81	10.18	8.77
October	91.07	13.25	14.77	56.00	10.00	9.22
November	84.00	12.50	13.75	56.00	10.00	9.42
December	84.00	12.50	13.64	56.00	10.00	9.29
Average for year	[5] 116.10	16.21	18.53	64.65	10.86	9.47

[1] Joplin: Metal Statistics, 1954, p. 594. St. Louis: Metal Statistics, 1954, p. 587. London: E&MJ Metal and *Mineral Markets and Quin's Metal Handbook.*
[2] Conversion of English quotations into American money based on average rates of exchange recorded by Federal Reserve Board.
[3] Revised figures.
[4] Average of daily mean of bid and asked quotations at morning session of London Metal Exchange.
[5] Represents average price realized on total shipments for year

before the market opened was £110 per long ton (equivalent to 13.75 cents a pound computed at an exchange rate of $2.80 to the pound sterling). By April 23, 1953, the market reached the low of the year at £63¾ (7.97 cents a pound); thereafter prices improved somewhat, closing December 31, 1953, in the range of £74¾ to £75 (9.34 to 9.37 cents). The average monthly quoted price of common zinc is given in table 26. Comparison of the St. Louis and London prices showed that the difference between the two ranged from 0.58 to 2.30 cents a pound but lessened considerably in the last quarter of the year.

TABLE 27.—Average price received by producers of zinc, 1949–53, by grades, in cents per pound

Grade	1949	1950	1951	1952	1953
Grade A:					
Special High grade	12.76	14.30	18.79	17.04	11.81
High grade	12.29	14.16	18.48	16.42	11.40
Grade B: Intermediate	12.94	14.69	18.57	17.76	11.38
Grades C and D:					
Brass Special	12.75	14.47	18.20	17.07	11.72
Select	12.87	17.37	18.00	16.73	11.59
Grade E: Prime Western	12.18	14.11	17.92	16.33	11.21
All grades	12.42	14.23	18.24	16.63	11.47
Prime Western; spot quotation at St. Louis [1]	12.15	13.88	17.99	16.21	10.86

[1] Metal Statistics, 1954, p. 587.

FOREIGN TRADE [8]

Imports.—Total imports (general imports) of zinc in ores and concentrates in 1953 established a peacetime high—513,000 tons—and were exceeded only in wartime 1943, when 539,000 tons was imported. Of the total 33 percent was obtained from Mexico, 32 percent from Canada, and 16 percent from Peru. The remaining 19 percent came chiefly from Bolivia, Union of South Africa, Australia, Yugoslavia, Italy, Spain, and Guatemala.

Imports of slab zinc during the year totaled 235,000 tons, more than double the 1952 total and a new record. Of the tonnage imported Canada supplied 46 percent, Mexico 14 percent, Italy 10 percent Belgium-Luxembourg 9 percent, and West Germany 6 percent. The bulk of the remaining 15 percent came from Peru, Norway, United Kingdom, Netherlands, and Australia.

Exports.—Exports of zinc in zinc ore, concentrate, dross and slab zinc, sheet, scrap and dust totaled 26,900 tons in 1953 valued at $8,338,000 compared with 66,300 tons in 1952 valued at $28,651,000. In addition to the export items listed in tables 30 and 31 considerable zinc was exported, as in other years, in brass, pigments, chemicals, and die-cast alloy and as zinc coatings on steel products. Export data on zinc pigments and chemicals are given in the Lead and Zinc Pigments and Zinc Salts chapter of this volume.

Exports of slab zinc totaling 17,900 short tons were chiefly to United Kingdom (78 percent), Brazil (9 percent), Belgium-Luxembourg (5 percent), and the Republic of Korea (4 percent). The

[8] Figures on imports and exports compiled by Mal B. Price and Elsie D. Page, Division of Foreign Activities, Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 28.—Zinc imported into the United States, in ores, blocks, pigs, or slabs, by countries, 1944–48 (average) and 1949–53, in short tons [1]

[U. S. Department of Commerce]

Country	1944–48 (average)	1949	1950	1951	1952	1953
Ores (zinc content):						
Algeria						2,804
Argentina	6,125		8	5,546	603	
Australia	12,546	4,956	2,366	2,825	2,398	10,820
Bolivia	12,242	3,526	3,810	7,849	[2] 14,603	22,547
Canada-Newfoundland-Labrador	83,750	61,314	77,525	96,568	[2] 149,130	165,737
Chile	6,907		40	1,088	33	3,247
Guatemala			473	6,539	[2] 9,744	6,477
Honduras	5	221	104	154	316	637
Italy	4,580					8,738
Japan	1,004				1,389	
Mexico	155,920	144,101	155,283	143,769	[2] 200,647	168,937
Netherlands						3,009
Peru	40,113	14,901	16,946	29,136	[2] 44,337	84,365
Philippines			42	86	1,664	2,104
Spain	2,485	4,880	17,738	4,392	16,647	8,617
Union of South Africa	408	6,568	3,794	2,655	4,917	13,356
Yugoslavia				1,756	2,512	10,820
Other countries	382	712	444	512	696	1,168
Total ores	326,467	241,179	278,573	302,875	[2] 449,636	513,383
Blocks, pigs, or slabs:						
Australia	4,439	103				3,951
Belgian Congo						882
Belgium-Luxembourg	229	1,933	3,617	612	6,854	21,549
Canada	56,510	109,708	108,937	85,066	[2] 69,775	107,925
French Morocco				440		
Germany			1,637		[2 3] 7,619	[3] 13,906
Italy	316		2,679		4,063	23,972
Japan	4,323				222	
Mexico	19,531	14,191	26,293	760	18,686	33,878
Netherlands			2,005	254	3,976	4,338
Northern Rhodesia						1,064
Norway	448	960	7,939	882	110	6,323
Peru			1,205	26	1,600	8,406
United Kingdom	([4])		555			6,317
Yugoslavia			485		2,788	1,900
Other countries	420	30	622	3	12	165
Total blocks, pigs, or slabs	86,216	126,925	155,974	88,043	[2] 115,705	234,576

[1] Data include zinc imported for immediate consumption plus material entering country under bond.
[2] Revised figure. [3] West Germany. [4] Less than 1 ton.

TABLE 29.—Zinc imported for consumption in the United States, 1944–48 (average) and 1949–53, by classes [1]

[U. S. Department of Commerce]

Year	Ores (zinc content)		Blocks, pigs, slabs		Sheets		Old, dross, and skimmings [2]		Zinc dust		Total value [3]
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1944–48 (average)	248,412	$13,145,197	85,802	$14,904,434	27	$7,176	6,473	$538,298	96	$10,020	$28,605,125
1949	109,535	11,748,199	125,564	29,340,620	32	8,144	3,732	558,702	17	4,397	41,660,062
1950	237,564	24,313,625	155,332	38,759,435	211	92,862	2,862	688,176	472	80,564	63,934,662
1951	197,995	27,043,611	88,043	31,109,279	149	84,044	6,603	284,030	154	74,362	58,595,326
1952	[4] 542,314	[4] 105,428,691	[4] 113,053	[4] 36,219,619	47	23,557	[4] 3,489	[4] 535,426	133	38,932	[4] 142,246,225
1953	449,391	47,918,150	227,654	50,281,745	196	76,507	5,915	556,592	1,045	161,612	98,994,606

[1] Excludes imports for manufacture in bond and export, which are classified as "imports for consumption" by the U. S. Department of Commerce.
[2] Includes dross and skimmings as follows: 1944–48 (average)—4,963 tons, $372,880; 1949—2,668 tons, $335,283; 1950—1,229 tons, $186,748; 1951—6,457 tons, $242,998; 1952—Revised figures, 3,019 tons, $389,361; 1953—2,925 tons, $250,544.
[3] In addition, manufactures of zinc were imported as follows: 1944–48 (average)—$8,945; 1949—$2,583; 1950—$142,369; 1951—$51,700; 1952—$11,719; 1953—$5,855.
[4] Revised figure.

4,600 tons of sheets, plates, strips, and other forms not otherwise specified was shipped to Canada (50 percent), Brazil (15 percent), and Mexico (12 percent), as well as to several minor purchasing countries listed, with quantities, in table 30.

TABLE 30.—Slab and sheet zinc exported from the United States, by destinations, 1950–53, in short tons

[U. S. Department of Commerce]

Destination	Slabs, pigs, and blocks				Sheets, plates, strips, or other forms, n. e. s.			
	1950	1951	1952	1953	1950	1951	1952	1953
Country:								
Argentina			661			100	305	2
Austria		466	986					
Belgium-Luxembourg	67			840	21	3	(1)	1
Brazil	830	3,967	4,089	1,687	74	310	621	697
Canada	24	1,702	171	7	2,778	2,668	1,686	2,322
Chile	190	466	365	141	18	70	66	31
Colombia	3		1	23	322	369	147	136
Cuba	274	199	33	12	131	176	73	99
Denmark	641	80						
Egypt			385					
France		933	6,689	56	(1)	367		
Germany		215	[2] 607			26	[2] 21	
India	4,588	4,728	2,036		417	807	304	352
Israel and Palestine	105	3	60	34	70	97	55	9
Italy	224							
Japan	374	816				45	3	11
Korea	77		[3] 90	[3] 661				[3] 94
Mexico	349	211	351	457	575	859	532	545
Pakistan		220	111		3	10	3	3
Philippines	4	5	3		54	140	43	104
Switzerland	112	823	498		11	20	23	13
Union of South Africa		1			37	69	45	18
United Kingdom	4,941	20,024	40,423	13,859	98	25	41	9
Yugoslavia		1,244			(1)			
Other countries	114	407	155	82	201	418	263	182
Total	12,917	36,510	57,714	17,859	4,810	6,579	4,231	4,628
Continent:								
North America	652	2,117	558	481	3,544	3,765	2,361	3,013
South America	1,026	4,440	5,189	1,883	481	1,098	1,236	950
Europe	6,035	23,789	49,270	14,789	158	489	152	31
Asia	5,204	5,814	2,309	705	587	1,147	432	616
Africa		5	388	1	40	70	45	18
Oceania		345				10	5	(1)

[1] Less than 1 ton.
[2] West Germany.
[3] Republic of Korea.

Tariff.—The duties on slab zinc (gross weight) and ores and concentrates (zinc content) were 0.7 and 0.6 cent per pound, respectively, from July 23, 1952, throughout 1953. The suspension of the tariff duty on zinc scrap was terminated June 30, 1953, and thereafter duty on such material was 0.75 cent per pound. These and other applicable duties, with changes, are presented in table 32.

The high level of imports established in 1952 was exceeded in 1953; and that, together with the depressed state of the domestic zinc- (and lead-) mining industry, stimulated much study of various protective tariff proposals and other plans whereby the domestic industry might be aided.

TABLE 31.—Zinc ore and manufactures of zinc exported from the United States, 1944–48 (average) and 1949–53

[U. S. Department of Commerce]

Year	Zinc ore, concentrates, and dross (zinc content)		Slabs, pigs, or blocks		Sheets, plates, strips, or other forms, n. e. s.		Zinc scrap (zinc content)		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1944–48 (average)	1,008	$130,596	49,758	$10,347,463	8,469	$2,961,237	(1)	(1)	706	$198,625
1949	[2] 2,925	[2] 477,718	58,709	18,699,597	7,456	3,496,169	1,570	$224,291	690	261,484
1950	[2] 1,140	[2] 264,907	12,917	3,967,055	4,810	2,322,150	6,212	674,235	506	186,557
1951	[2] 3,090	[2] 792,800	36,510	15,592,994	6,579	4,360,689	4,613	871,302	723	400,656
1952 [3]	[2] 3,370	[2] 899,162	57,714	24,508,568	4,231	2,960,769	972	282,816	(4)	(4)
1953 [3]	[2] 2,953	[2] 758,600	17,859	4,591,792	4,628	2,637,240	1,000	169,517	502	181,055

[1] Not separately classified before Jan. 1, 1949; formerly included with "Other forms, n. e. s."
[2] Effective Jan. 1, 1949, "dross" included with "scrap."
[3] Effective Jan. 1, 1952, zinc and zinc alloy semifabricated forms, n. e. c., were exported as follows: 1952—$191,746 (quantity not available); 1953—286 tons, $151,496.
[4] Effective Jan. 1, 1952, "dust" included with "scrap."

A basic study embodying recommendations on general tariff policy was made by the Foreign Economic Policy Commission (Randall Committee) in a report to the President and the Congress released January 23, 1954. Subsequently the staff papers [9] prepared for use of the Commission in formulating its policy were published.

The Tariff Commission, in response to resolutions of the United States Senate Committee on Finance and the House of Representatives Committee on Ways and Means, undertook a study of the zinc and lead industries, to determine facts relevant to the competitive position of the industry and the effect of imports of zinc and lead on employment at domestic mines and smelters. That report [10] showed that the existing tariff structure restricted imports but slightly and that during the past decade a substantial part of all zinc imports was exempted from duty. It stated that in the postwar period (1946–September 1953) 33 percent of all unmanufactured zinc imported for consumption was entered duty free.

On September 14, 1953, a petition for "escape-clause" relief under section 7 of the Trade Agreements Extension Act of 1951 as amended was filed with the Tariff Commission by an industry group, the National Lead and Zinc Committee. On September 16 the Tariff Commission began the investigation [11] to determine whether lead and zinc imported into the United States under customs treatment or duties reflecting concessions granted under the General Agreement on Tariffs and Trade (GATT) were in such increased amounts as to cause or threaten serious injury to the domestic lead and zinc industries.

[9] Staff Papers Presented to the Commission on Foreign Economic Policy, available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.; price $1.75.
[10] Work cited in footnote 3.
[11] The report based on this investigation was transmitted to the President May 21, 1954. The Tariff Commission found that the domestic industry was injured as a result of concessions granted and recommended specific tariff increases.

TABLE 32.—Zinc articles: United States rates of duty imposed under Tariff Act of 1930, in specified years, 1930–54

[United States Tariff Commission]

Item	Tariff rate in—				
	1930	1945	1948	1951	1954
	Cents per pound; percent ad valorem				
Par. 77:					
Zinc oxide and leaded zinc oxides containing not more than 25 per centum of lead:					
In any form of dry powder	1¾	[1] 1 1/10	[2] 6/10	6/10	6/10
Ground in or mixed with oil or water	2¼	[1] 1½	[2] 1	1	1
Lithopone, and other combinations or mixtures of zinc sulfide and barium sulfate:					
Containing by weight less than 30 per centum of zinc sulfide	1¾	[3] 1½	[2] ⅞	⅞	⅞
Containing by weight 30 per centum or more of zinc sulfide	1¾	1¾	⅞	⅞	⅞
	15%	15%	[2] 7½%	7½%	7½%
	Cents per pound of zinc content				
Par. 393: Zinc-bearing ores of all kinds, except pyrites containing not more than 3 percent zinc	1½	[1] [4] ¾	[2] ¾	[5] 9/10	[5] 9/10
	Cents per pound				
Par. 394:					
Zinc blocks, pigs, or slabs	1¾	[1] [4] ⅞	[2] ⅞	[5] 7/10	[6] 7/10
Old and worn-out zinc, fit only to be remanufactured, zinc dross, and zinc skimmings	1½	[3] [7] ¾	[2] [7] ¾	[7] ¾	[7] ¾
Zinc dust [8]	1¾	[1] [4] ⅞	[2] ⅞	[5] 7/10	7/10
Zinc sheets	2	[1] 1	[3] 1	1	1
Zinc sheets coated or plated with nickel or other metal (except gold, silver, or platinum), or solutions	2¼	[1] 1⅛	[2] 1⅛	1⅛	1⅛

[1] Trade agreement with Mexico, effective Jan. 30, 1943, through Dec. 31, 1950.
[2] General Agreement on Tariffs and Trade (GATT) (Geneva), effective Jan. 1, 1948.
[3] Trade agreement with Netherlands, effective Feb. 1, 1936, through Dec. 31, 1947.
[4] Rate previously reduced in the trade agreement with Canada, effective Jan. 1, 1939, through Dec. 31, 1947, to 1⅛ cents per pound of zinc content on zinc-bearing ores and to 1⅜ cents per pound on zinc blocks, pigs, and slabs, and on zinc dust.
[5] GATT (Torquay), effective June 6, 1951.
[6] Duty suspended from Feb. 12, 1952, to July 23, 1952, inclusive (Public Law 258, 82d Cong).
[7] Duty on metal scrap suspended for practically the entire period from Mar. 14, 1942, to June 30, 1953, inclusive (Public Law 497, 77th Cong.; Public Laws 384 and 613, 80th Cong.; Public Law 869, 81st Cong.; and Public Laws 66 and 535, 82d Cong.).
[8] Since the enactment of Public Law 497 (77th Cong.), effective Mar. 14, 1942, and subsequent amendments (see note 7 above), providing for temporary suspension of duties on metal scrap, quantities of zinc dust have been entered free of duty under this law. No information is available as to the distinction between the zinc dust which has entered free of duty and that which has entered as dutiable.

TECHNOLOGY

Geochemical prospecting of Canadian glacial terrain for zinc and copper was described in a recent issue [12] of Mining Engineering. The paper described the results of testing soil, using "dithizone," over known deposits covered by glacial till.

The geology of the [13] important Friends Station–New Market area of the eastern Tennessee mining district and the ore deposits [14] of the Metaline district, northeastern Washington, were described at the

[12] Bischoff, C. T., Testing for Copper and Zinc in Canadian Glacial Soils: Min. Eng., vol. 6, No. 1, January 1954, pp. 57–61.
[13] Oder, Charles R. L., The Friends Station–New Market Zinc-bearing Area in East Tennessee: Pres. before Soc. Econ. Geol., New York, N. Y., February 1954.
[14] Mills, Hiram F., Productive Ore Deposits of the Metaline District: Pres. before Soc. Econ. Geol., New York, N. Y., February 1954.

annual meeting of the Society of Economic Geologists, New York, N. Y., February 1954.

The technology of mining, metal extraction, and use of zinc in recent years and particularly in 1953 was largely directed toward reducing costs through mechanization and improved extraction techniques.

A recent article [15] described a system of mechanized mining developed and used at the Grandview zinc-lead mine, Washington, since January 1952. The equipment consists of a self-loading, crawler-type transport termed a "Gismo," having a carrying capacity of 5 to 5½ tons of ore, and a second such unit equipped as a 3- or 5-drill jumbo, with a HD5–F Allis-Chalmers diesel tractor modified for the use. Using this equipment to integrate drilling, loading, and transportation with other equipment, the ore output per man-shift was raised from 15 tons in 1950 to 122 in 1953, while labor costs were reduced from $1.57 per ton in 1950 to $0.72 in 1953.

Mechanization and trackless mining at the North Friends Station mine, Tennessee, were described.[16] This operation utilized rubber-tired drilling rigs, tractor-mounted loaders, and 8¼-ton-capacity diesel-powered trucks, the latter hauled the ore from the stope face out of the mine through an 1,100-foot inclined haulageway to surface railway cars.

Trackless mining was used throughout 1953 at the Pend Oreille mine, Washington. It was based on crawler-type, tractor-mounted jumbos, crawler-type, tractor-mounted loaders, and diesel-powered trucks, which are described in detail in still another article.[17] The trackless mining equipment at the Pend Oreille mine increased output per man-shift from the 8 tons obtained by scraper mining methods to 25 tons, at the same time effecting a cost reduction per ton from $2.15 to $1.14.

Somewhat similar equipment and use were described in another technical paper [18] concerning the Tri-State Zinc, Inc., mining operation in northern Illinois.

An unusual open-pit mining technique [19] was used throughout 1953 at the Quick Seven mine in southwest Missouri. Previous mining and drilling indicated that the ore body was a cylindrical mass some 500 feet in diameter and 185 feet in vertical dimension. Management solved the problem of getting the ore from the pit by installing a hammerhead crane with a 131-foot outboard arm and a 10-ton skip at the pit's edge.

The new Van Stone open-pit zinc mine, which was put into production November 1952, operated throughout the year and was described in two technical papers [20] covering mining and milling at

[15] Engineering and Mining Journal, How Mechanized Mining at Grandview Upped Output and Cut Costs: Vol. 155, No. 5, May 1954, pp. 56–59.

[16] Waldron, Howard L., Mechanization and Trackless Mining Slash Costs at North Friends Mine: Min. World, vol. 15, No. 13, December 1953, pp. 38–42.

[17] Kinney, L. M., Trackless Mining at Pend Oreille: Min. Cong. Jour., vol. 29, No. 11, November 1953, pp. 28–29, 105.

[18] Allen, V. C., Mechanization at an Upper Mississippi Valley Zinc-Lead Mine: Bull. Inst. Min. and Met., vol. 63, No. 556, March 1953, pp. 261–269.

[19] Mining World, A New Method of Open Pitting: Vol. 14, No. 10, September 1952, pp. 36–39.

[20] Huttl, John B., A. S. & R.'s Van Stone Mine: Eng. and Min. Jour., vol. 154, No. 4, April 1953, pp. 72–76.

Mining World, Van Stone, American Smelting's Newest Zinc Operation: Vol. 15, No. 4, April 1953, pp . 26–31, 68.

this 1,000-ton-per-day plant. Modern design, to accomplish economy in operation and control, characterized the operation.

Block caving, one of the stoping methods in use at the Bunker Hill mine at Kellogg, Idaho, was reported in a recent issue of Mining World.[21]

The ore body, which contained 716,000 tons of 2.0-percent zinc and 1.0-percent lead ore with 0.5 ounce of silver per ton was block-caved successfully until low zinc and lead prices forced cessation in mid-1953. Total mining and milling costs, including exploration stope preparation and proportionate administrative and service costs, were reported on the basis of the first 10 months of 1952 to be $3.97 a ton.

Other technical articles of interest on zinc mining dealt with reducing drilling costs,[22] the use of steel rail [23] in place of timbered sets, pressure grouting [24] at the Deep Creek mine, Washington, an adaptation of oil-well drilling to mine exploration [25] at the Ruby Hill property, Nevada, and sinking [26] of the Iron King No. 7 shaft, Arizona.

In ore dressing, several articles dealt with recent developments. One of these [27] described the flotation of zinc carbonate and zinc silicate as practiced in Sardinia, Italy, at the San Giovonni and Buggeru mines and also on dump material in France. The authors state:

> Since the beginning of 1953 tests have been underway in Morocco at the Touissit mine of Compagnie Royale Asturienne des Mines and the Zellidja mine of Société des Mines de Zellidja. In spite of the present low price of zinc an attempt will be made to install the process as a commercial operation.

Success in the venture would result in a greatly expanded potentiality in the north African mines, as many Moroccan zinc ores are highly oxidized and hence largely unrecovered in present ore-dressing plants.

Another article [28] described an economically successful flowsheet based on the complex Iron King mine ore (Arizona), which contains lead, zinc, copper, gold, and silver. Close control was exerted to maintain optimum recoveries in terms of smelter returns on the zinc, lead, and pyrite concentrates produced.

Developments [29] in milling practice in southeast Missouri included replacing crushing rolls with wetgrinding rod mills, the installation of short-head cone crushers, the satisfactory retreatment of table and jig tailings by flotation to recover both lead and zinc and the installation of a heavy-medium process at the Hayden Creek mine.

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[21] Mining World, How Bunker Hill "Stair-Step" Block-Caves Low-Dip Lead-Zinc Ore Body in Quartzite: Vol. 15, No. 8, July 1953, pp. 57 and 59. (Describes paper delivered by C. E. Schwab at the 1953 annual meeting of the AIME Inst., Los Angeles, Calif.

[22] Mining World, Are Your Drilling Costs Too High: Vol. 16, No. 3, March 1954, pp. 42–45.

[23] Doyle, Wm. R., Steel Rail Sets at Resurrection: Min. Cong. Jour., vol. 39, No. 10, October 1953, pp. 49–52, 65.

[24] Quine, A. V., Pressure Grouting at Deep Creek: Min. Eng., vol. 6, No. 3, March 1954, pp. 279–281.

[25] Mining World, Eureka Corporation Found It—a Way to Adapt Oil-Well Methods to Mine Exploration: Vol. 15, No. 9, August 1953, pp. 40–43.

[26] Tomkinson, E. R., Sinking Iron King's No. 7 Shaft: Min. Cong. Jour., vol. 39, No. 10, October 1953, pp. 36, 37.

[27] Rey, M., Sitia, G., Raffinot, P., and Formanek, V., Flotation of Oxidized Zinc Ores: Min. Eng., vol. 6, No. 4, April 1954, pp. 416–420.

[28] Mining World, Iron King Uses Close Control: Vol. 15, No. 2, February 1953, pp. 26–29.

[29] Stockett, Norman A., Developments in Milling Practice in Southeast Missouri: Min. Cong. Jour., vol. 39, No. 4, April 1953, pp. 84–87.

During the year the New Jersey Zinc Co. reported [30] the development of a fluid-bed roasting process for sulfide ores, which eliminates sintering before the smelting operation. An experimental unit of commercial capacity was operated at the Palmerton smelter throughout 1953.

Fluosolids roasting of the zinc sulfide to make contact acid at the Aluminum Co. of Canada, Ltd., Arvida, Quebec, was described.[31]

The Blackwell Zinc Co. sintering hearth at Blackwell, Okla., was the subject of a descriptive paper [32] presented at the annual meeting of the American Institute of Mining and Metallurgical Engineers, Los Angeles, February 1953. The sintering hearth is charged with green concentrate and crushed returned sinter fines in the ratio of about 1:5 to produce finished sinter analyzing about 66 percent zinc, 0.3 percent lead, and 0.1 percent cadmium. Lead-cadmium fume is collected in a 9,360-orlon-unit baghouse, and the sinter is retorted in the horizontal retorts, of which 11,200 are operating on a 48-hour cycle.

The installation of a 300-ton-per-day induction furnace at Tadanac, British Columbia, for melting the Consolidated Mining & Smelting Co. electrodeposited zinc sheets was reported [33] recently. The new, Italian-designed furnace is expected to reduce greatly dross formation and eliminate largely the zinc oxide fume, as well as lower melting costs. A second unit is planned as the overall smelter capacity is 520 tons of zinc per day.

Advances were also recorded in numerous areas of zinc use. Many of these dealt with developments in the field of zinc coatings. During 1953, 2 additional continuous galvanizing lines were installed bringing the total at year's end to 18, with 5 more under construction and still others contemplated. The continuous line [34] was described in detail in a recent two-part article in Steel. The importance of improved product and manufacturing processes is emphasized by the fact that galvanized sheet produced in 1953 was worth an estimated $280,000,000. The development of continuous galvanizing in the United States was described by Nelson E. Cook [35] in a paper presented at Oxford, England, July 7, 1954.

Hot-dip galvanizing also received considerable attention in the technical press as work progressed in improving corrosion resistance, workability, and surface quality.[36 37 38]

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[30] Waring, R. K., Research (at New Jersey Zinc Co.): Min. Eng., vol. 5, No. 12, December 1953, pp. 1234, 1235; Am. Met. Market, vol. 61, No. 4, Mar. 20, 1954, page 7.

[31] Anderson, T. T., and Bolduc, R., Fluosolids Roasting of Zinc Concentrates for Contact Acid: Chem. Eng. Prog., vol. 49, No. 10, October 1953, pp. 527–532.

[32] Lee, A. F., Jr., Sintering Zinc Concentrates on the Blackwell 12 by 168 Ft. Machine: Jour. Metals, vol. 5, No. 12, December 1953, pp. 1631–1633.

[33] Canadian Chemical Processing, Electrolytic Zinc at Cominco Expands Facilities: Vol. 37, No. 11, October 1953, p. 72.

Iron Age, Electric Furnace for Zinc Melting: Vol. 172, No. 14, Oct. 1, 1953, p. 47.

[34] McArthur, D. A., Geisgler, A. R., and Upton, John, Jr., New Angles for the Galvanizing Line and Continuous Galvanizing Line: Steel, vol. 134, No. 14, Apr. 5, 1954, pp. 100–102; and No. 15, Apr. 12, 1954, pp. 102–104.

[35] Cook, Nelson E., The Development of Continuous Galvanizing in the United States: Am. Metal Market, vol. 61, No. 134, July 15, 1954, pp. 3–11.

[36] Frazier, K. S., Controlled Hot-Dip Galvanizing: Steel, vol. 134, No. 8, Feb. 22, 1954, pp. 102–103; No. 9, Mar. 1, 1954, pp. 98–99; No. 10, Mar. 8, 1954, pp. 138–139.

[37] Baldwin, Allen T., Electroplating Prior to Hot-Dip Galvanizing for Improved Results: Metal Prog., vol. 64, No. 6, December 1953, pp. 76–81.

[38] Horwick, Ernest W., The New Look in Galvanized Steel· Materials and Methods, vol. 39, No. 3, Mar. 1954, pp. 107–109.

An article on radiant burners[39] set forth the necessity of maintaining uniform galvanizing pot temperature to assure uniform coatings and stressed that overheating speeds up the formation of dross.

The zinc plating of large-caliber steel cartridge cases was described by the officials of a California ordnance plant.[40]

Electrodeposits of zinc-tin alloys are finding wide use for plating radio and television chassis, switch gear, nuts, bolts, and steel, copper, and brass parts for electrical installations, according to Cuthbertson[41] of the Tin Research Institute in England. A summary[42] of recent research on electrodeposition of the alloy was described in Chemical Age.

Zinc-rich paints were marketed under a variety of trade names in 1953, with claims that, unlike ordinary rust protective paints, these can be used effectively over rust and mill scale, because of the sarificial, cathodic protection offered by the zinc dust of the paint.

The vacuum metallizing[43] of die-cast zinc with bright-finish aluminum was described recently as giving a high luster finish at a sixth of the cost of chromium electroplating. The prevention of corrosion by metallizing[44] steel and iron surfaces with zinc was recounted in Metal Progress, and examples of long-term use on barges, lock gates, and tanks were given.

During 1953 the Bureau of Mines published the following Reports of Investigations that relate to zinc:

Browning, J. S., and Clevenger, C. B., Process for Beneficiating Great Gossan Lead Ores, Carroll County, Va.: Rept. of Investigations 4945, 14 pp.
Townsend, J. W., Investigation of Lead-Zinc Deposits at the Harrington-Hickory Mine, Beaver County, Utah: Rept. of Investigations 4953, 2 pp.
Roberts, Edward, Mine Timber Preservation by the Collar Method (injection of chromated zinc chloride): Rept. of Investigations 4980, 14 pp.
Popoff, C. C., Lead-Zinc Deposits of the Dunkelberg District, Granite County, Mont.: Rept. of Investigations 5014, 41 pp.

Publications of the Geological Survey relating to zinc and issued in 1953 are:

Harrison, J. E., and Leonard, B. F., Preliminary Report on the Jo Reynolds Area, Lawson-Dumont District, Clear Creek County, Colo.: Circ. 213, 9 pp.
Agnew, A. F., Flint, A. E., and Allingham, J. W., Exploratory Drilling Program of the United States Geological Survey for Evidences of Zinc-Lead Mineralization in Iowa and Wisconsin: Circ. 231, 37 pp.
Behre, C. H. Jr., Geology and Ore Deposits of the West Slope of the Mosquito Range: Prof. Paper 235, 176 pp.
Gault, H. R., and Fellows, R. E., Zinc-Copper Deposits at Tracy Arm, Petersbury District, Alaska: Bull. 998-A, 13 pp.
Gault, H. R., Rossman, D. L., Flint, G. M. Jr., and Ray R. G., Some Zinc-Lead Deposits of the Wrangell District, Alaska: Bull. 998-B, 43 pp.
Robinson, G. D., and Twenhofel, W. S., Some Lead-Zinc and Zinc-Copper Deposits of the Ketchikan and Wales Districts, Alaska: Bull. 998-C. pp. 59-83.

WORLD REVIEW

World smelter production of zinc established an alltime high in 1953, totaling 2,320,000 metric tons—5 percent above the 1952 out-

[39] Breckenridge, R. M., and Rasmussen, K. E., Radiant Burners Improve Galvanizing Quality, Cut Costs: Iron Age, vol. 172, No. 19, Nov. 5, 1953, pp. 168-171.
[40] Fisher, E. E., and Flatnik, D. F., Zinc Plate on Cartridge Cases Meets Rigid Specifications: Iron Age, vol. 173, No. 10, Mar. 11, 1954, pp. 135-139.
[41] Cuthbertson, J. W., News item—New Plating Alloy: Metal Bull. (London), No. 3888, Apr. 27, 1954, p. 24.
[42] Chemical Age (London), Electrodeposition of Zinc-Tin Alloys, a Summary of Recent Work in Italy: Vol. 68, No. 1752, Feb. 7, 1953, pp. 253-254.
[43] Materials and Methods, Vacuum Metallizing: Vol. 39, No. 2, Feb. 1954, pp. 108-109.
[44] Vanderpool, Howard, Prevention of Corrosion by Metallizing the Surface: Metal Prog., vol. 64, No 5, November 1953, pp. 161-164, 166, 168, 170, 172.

put. World mine production of zinc also established a new record despite a considerable decrease in the output of United States mines. Tables 33 and 34 show the quantity of zinc mined and smelted throughout the world by individual countries. The United States, which consumes over 40 percent of the world zinc, mined about 20 percent and smelted approximately 35 percent of the total.

TABLE 33.—World mine production of zinc (content of ore),[1] by countries,[2] 1944–48 (average) and 1949–53, in metric tons [3]

[Compiled by Pauline Roberts and Berenice B. Mitchell]

Country [2]	1944–48 (average)	1949	1950	1951	1952	1953
North America:						
Canada	266,616	261,506	284,153	309,450	337,291	362,909
Guatemala	----------	(4)	332	6,500	8,200	6,100
Honduras [5]	5	201	94	140	287	578
Mexico	188,657	178,402	223,530	180,064	227,375	226,538
United States [6]	576,135	538,142	565,513	617,961	604,183	496,618
South America:						
Argentina	15,044	10,921	12,699	15,475	15,396	16,089
Bolivia (exports)	18,444	17,666	19,570	30,535	35,619	23,974
Peru	59,077	72,037	87,961	101,300	127,845	134,127
Europe:						
Austria	2,126	2,694	2,970	3,355	4,986	4,378
Finland [7]	2,200	2,500	2,100	3,000	7,000	3,200
France	4,389	10,907	12,178	13,283	14,600	[6] 12,000
Germany, West	69,565	57,816	70,153	75,294	80,680	91,618
Greece	1,170	3,100	3,184	6,300	7,300	7,500
Ireland	----------	----------	762	2,355	3,124	(4)
Italy	38,373	74,562	87,026	100,733	112,914	101,540
Norway	4,631	6,603	5,702	5,469	5,588	5,000
Poland [6]	69,930	85,300	86,200	86,200	95,300	110,000
Spain [7]	38,200	50,000	64,000	74,000	86,000	83,000
Sweden	35,148	35,158	37,121	38,318	47,162	41,538
U. S. S. R. [7 8]	95,800	110,000	128,800	148,000	186,000	212,000
United Kingdom	2,484	----------	36	194	1,549	2,891
Yugoslavia	21,054	44,017	38,092	39,420	47,789	59,970
Asia:						
Burma	----------	----------	----------	----------	750	3,900
India [7]	----------	----------	300	1,100	2,000	2,100
Indochina	357	----------	----------	----------	----------	----------
Iran	----------	----------	----------	----------	12,000	5,000
Japan	35,712	44,268	52,032	64,416	87,468	104,670
Korea, Republic of	2,282	----------	----------	(4)	500	20
Philippines	----------	----------	50	150	1,600	750
Thailand (Siam)	[9] 5	70	270	520	500	(4)
Turkey [7]	608	200	60	500	1,200	(4)
Africa:						
Algeria	3,961	6,863	7,167	9,466	11,192	19,160
Angola	----------	----------	----------	350	40	100
Belgian Congo	33,037	55,420	74,805	88,705	98,948	125,791
Egypt	[10] 60	284	382	1,432	886	200
French Equatorial Africa	224	44	621	518	377	----------
French Morocco	1,470	2,847	11,412	19,455	28,352	35,460
Nigeria	74	72	----------	----------	52	64
Northern Rhodesia [6]	18,334	23,217	23,080	22,953	23,257	25,737
South-West Africa	3,197	12,700	11,300	14,800	15,600	15,800
Tunisia	1,630	3,337	2,932	3,548	3,540	3,650
Australia	176,652	184,919	205,632	197,843	204,380	[6] 204,200
Total (estimate)	1,788,000	1,910,000	2,140,000	2,300,000	2,570,000	2,580,000

[1] Data derived in part from the Yearbook of the American Bureau of Metal Statistics, the United Nations Statistical Yearbook, and the Statistical Summary of the Mineral Industry (Colonial Geological Surveys, London).

[2] In addition to countries listed, Bulgaria, Czechoslovakia, East Germany, North Korea, and Rumania also produce zinc, but production data are not available; estimates by senior author of chapter included in total.

[3] This table incorporates a number of revisions of data published in previous Zinc chapters.

[4] Data not available; estimate by senior author of chapter included in total.

[5] United States imports.

[6] Recoverable.

[7] Estimated.

[8] Smelter production.

[9] Average for 1 year only, as 1948 was first year of production.

[10] Average for 1947–48.

TABLE 34.—World smelter production of zinc, by countries, 1944–48 (average) and 1949–53, in metric tons [1] [2]

[Compiled by Pauline Roberts and Berenice B. Mitchell]

Country	1944–48 (average)	1949	1950	1951	1952	1953
North America:						
Canada	165,535	186,920	185,398	198,290	201,575	224,715
Mexico	49,057	53,496	53,491	58,750	[3] 50,387	[3] 53,053
United States	717,105	739,154	765,176	799,800	820,525	831,072
South America:						
Argentina	1,601	2,651	[4] 7,530	10,629	10,000	11,600
Peru	1,289	1,261	1,262	879	5,216	8,908
Europe:						
Belgium [5]	77,325	176,568	177,326	200,886	186,799	193,427
Czechoslovakia	[6] 2,466	(7)	(7)	(7)	(7)	(7)
France	29,015	58,916	71,531	74,557	80,064	80,938
Germany:						
East	(7)	(7)	(7)	(7)	(7)	(7)
West	[6] 22,983	86,916	122,796	140,640	147,216	148,261
Italy	14,534	26,917	37,925	47,752	54,851	60,033
Netherlands	5,447	15,614	19,752	22,605	25,905	25,202
Norway	25,559	41,090	43,173	40,825	39,232	37,820
Poland	69,930	85,300	86,200	86,200	95,300	110,000
Rumania	[8] 2,533	[4] 3,200	3,000	(7)	(7)	(7)
Spain	18,792	19,551	21,264	21,345	21,358	22,911
Sweden	944					
U. S. S. R.[4]	95,800	110,000	128,800	148,000	186,000	212,000
United Kingdom	68,863	65,144	71,418	70,851	69,839	73,875
Yugoslavia	4,260	9,903	12,315	13,223	14,463	14,549
Asia:						
China [4]	262	180	180	180	180	360
Indochina	[4] 125					
Japan	27,520	32,232	49,008	56,340	70,032	80,112
Africa:						
Belgian Congo						7,801
Northern Rhodesia	18,334	23,217	23,080	22,953	23,257	25,737
Australia	79,158	82,255	84,995	78,246	88,841	91,625
Total (estimate)	1,525,000	1,825,000	1,970,000	2,100,000	2,200,000	2,320,000

[1] Data derived in part from the Yearbook of the American Bureau of Metal Statistics, the United Nations Monthly Bulletin and the Statistical Yearbook, and the Statistical Summary of the Mineral Industry (Colonial Geological Surveys, London).
[2] This table incorporates a number of revisions of data published in previous Zinc chapters.
[3] In addition other zinc-bearing materials totaling 3,398 tons in 1952 and 27,477 in 1953.
[4] Estimate.
[5] Includes production from reclaimed scrap.
[6] 1945–48 average.
[7] Data not available; estimate by senior author of chapter included in total.
[8] 1946–48 average.

NORTH AMERICA

Canada.[45]—Mine production of zinc in Canada increased 28,000 tons above 1952 to 400,000 short tons despite lower metal prices and consequent closing of a number of zinc and lead mines.

New properties were explored and developed at a high rate as work continued in the Bathurst area of New Brunswick, the Pine Point area of the Northwest Territories, and elsewhere. An important new copper-zinc discovery was made in the spring of 1953 at Manitouwadge, northern Ontario. On the basis of outcrop studies and surface drilling several million tons of ore was indicated and inferred.

British Columbia was again the leading zinc-producing Province, yielding about 188,000 tons of mine production compared with 174,000 tons in 1952. The Consolidated Mining & Smelting Co., Ltd., operating mines and a smelter in British Columbia, was Canada's largest producer, with a smelter output of 185,900 short tons of zinc in refined

[45] Neelands, R. E., Zinc in Canada, 1953 (Preliminary): Canada Dept. of Mines and Tech. Surveys, Ottawa, pp. 1–7.

and unrefined products (161,400 tons in 1952). The company annual report for 1953 stated:

The major postwar construction program in which your company has been engaged approached completion by the end of 1953. The underground crushing plant at the Sullivan mine, the 3,700-level tunnel and haulageway to the mill, the sink-float plant at the mill, and the new main shaft to the lower levels of the mine were all completed at Kimberley in 1949. In the same year the second slag-fuming furnace was constructed at Trail. The Tulsequah mines came into production in 1951, followed by the Bluebell mine in 1952. Construction at the H. B. mine was virtually completed in March 1953 but, as noted elsewhere, operation has been deferred for the present. Part of the 86-mile transmission line from the Kootenay River power plants to Kimberley was energized in April 1952 to supply the Bluebell mine and the remainder was brought into service in February 1953 * * *. The 66-ton zinc plant extension was completed in 1953.

The construction program resulted in increased production capacity and labor productivity, as well as improved recoveries. During 1953 the Sullivan mine produced 2,643,000 tons of ore compared with 2,700,000 tons in 1952. The Bluebell lead-zinc mine at Riondel, B. C., produced 216,400 tons of ore during 1953, its first full year of operation. In the Atlin district of northern British Columbia the Tulsequah Chief and Big Bull zinc-copper-lead mines produced 173,100 tons of ore compared with 96,000 tons in 1952. The increase was made possible by an expansion of mill capacity to 500 tons a day early in the year. The technical press dealt extensively with the operations of the Consolidated Mining & Smelting Co.[46]

Canadian Exploration, Ltd., completed a large-scale development program at its Salmo, B. C., tungsten-lead-zinc property but owing to declining lead-zinc prices reduced ore to the mill in December from 1,800 tons a day to 1,200 tons.

Sil-Van Consolidated Mining & Milling Co., Ltd., began to produce lead and zinc concentrates at its new 150-ton mill near Smithers.

Sheep Creek Gold Mines, Ltd., built a 450-ton-capacity mill to treat zinc-lead-barite ore from its Mineral King mine west of Lake Windermere. Production is expected in early 1954.

During the year Britannia Mining & Smelting Co., Ltd.,[47] produced 839,400 tons of ore from its Britannia mine on Howe Sound. All zinc-ore production was suspended, however, and such zinc as was produced was a byproduct from copper ores.

Quebec was the second most important zinc-mining Province and produced 100,600 tons of zinc as compared with 94,900 tons in 1952 (revised figure). The open-pit mine of Barvue Mines, Ltd.,[48] near Barville, Barraute township, about 75 miles northeast of the Noranda mining district, operated throughout the year at a rate of 4,000 to 5,000 tons of ore per day. Through the 10-month period ended with October 1,125,500 tons of ore had been mined and milled and another 442,000 tons of waste was mined and removed from the hanging wall of the pit. In that month 5,100 tons of premium grade zinc-silver concentrate was produced, and it was anticipated that production in

[46] Mine and Quarry Engineering (London), The Sullivan Mine: Vol. 19, No. 10, October 1953, pp. 354–362; The Sullivan Concentrator: Vol. 19, No. 11, November 1953, pp. 386–395.
Canadian Mining Journal, The Consolidated Mines & Smelting Co. issue: Vol. 75, No. 5, May 1954; covers all units, giving history, geology, mining, ore dressing, smelting, refining, power, engineering, research, sales, safety, etc.

[47] Howe Sound Co., Annual Report 1953.

[48] Park, Allen S., Barvue Zinc, The Mine That Started Big: Compressed-Air Mag., January 1954, pp. 10–14.
American Metal Market, Further Progress Achieved in Developing Barvue Mines Project: Vol. 60, No. 240, Dec. 15, 1953, p. 7.

the future would range from 5,000 to 6,000 tons of such concentrate monthly. It is reported that total operating, mining, and milling costs, which were close to $3.00 a ton at the outset, were well below $2.00 and are expected to approximate $1.75 a ton. The concentrate was shipped by rail to Arvida, Quebec, where it is roasted to recover SO_2 fumes. The zinc calcine is then shipped to the United States to the American Zinc, Lead & Smelting Co. for smelting. Ultimate sale is at the rate of 17.5 cents a pound of zinc recovered in the first 175,000 tons of concentrate.

The Quemont Mining Corp., Ltd.,[49] treated 631,600 tons of copper-zinc ore to produce 52,300 tons of copper concentrate (18.12 percent copper) and 22,100 tons of zinc concentrate (51.42 percent zinc). Production would have been greater had not a strike stopped operations from October 2 through the balance of the year to February 16, 1954. All zinc concentrate was shipped to the United States. During the 280-day operation 12,329 feet of development work and 94,059 feet of diamond drilling were accomplished. Indicated ore reserves at the end of the year above the 2,340-foot level totaled 9,528,000 tons averaging 2.76 percent zinc, 1.47 percent copper, 0.159 ounce of gold, 1.07 ounces silver, and 45 percent pyrite.

The Normetal Mining Corp., Ltd., milled 290,800 tons of 6.59-percent zinc and 2.23-percent copper to produce 29,400 tons of 51.75-percent zinc concentrate and 28,100 tons of 20.94-percent copper concentrate. Production was reduced by a labor strike that extended from October 17 until February 17, 1954. Ore reserves at the year end were estimated to be 2,416,100 tons of 8.14-percent zinc and 2.61-percent copper.

Other Quebec producers were the Waite Amulet Mines, Ltd., which milled 372,800 tons of 4.06-percent zinc and 4.33-percent copper ore to recover 15,300 tons of copper and 11,300 tons of zinc before closure October 21 by a strike, and the Weedon Pyrite & Copper Corp., Ltd. West MacDonald Mines, Ltd., has acquired a large zinc pyrite property 7 miles north of Noranda's Horne mine, and Noranda Mines, Ltd., is building a 1,500-ton-per-day mill to treat the ore, which averages about 3 percent zinc and 80 percent pyrite.

The Hudson Bay Mining & Smelting Co., Ltd., operates a large copper-zinc mine, copper smelter, and electrolytic zinc plant at Flin Flon, Manitoba. The ore body lies in both Manitoba and Saskatchewan Provinces, but the major production has been from Saskatchewan for several years. The Flin Flon mine produced 1,497,100 tons of ore containing 48 percent zinc, 2.9 percent copper, and some gold and silver. Of this tonnage 1,478,100 tons was milled to yield 298,100 tons of 12.43-percent copper concentrate containing 4.3 percent zinc and 115,400 tons of 45.4-percent zinc concentrate containing 0.94 percent copper. All copper concentrate and the leached residues from the electrolytic zinc plant are smelted to recover copper, gold, and silver. The zinc content largely accumulates in the copper reverberatory slag, and in 1953, 419,500 tons of reverberatory slag containing 8.2 percent zinc was fumed to recover 42,900 tons of 71.0-percent zinc oxide fume. In 1953, 122,500 tons of zinc concentrates and the 42,900 tons of fume were treated to yield 65,700

[49] Quemont Mining Corp., Ltd., Annual Report: 1953.

tons of slab zinc. As of December 31, 1953, ore reserves, exclusive of subsidiaries, were 17,500,000 tons of 3.9-percent zinc and 3.23-percent copper. In addition 857,000 tons of zinc-plant residues containing 26.6 percent zinc, 1.04 percent copper, 0.143 ounce of gold, and 3.83 ounces of silver were held for re-treatment.

The Buchans Mining Co., Ltd., Newfoundland, milled 346,000 tons of zinc-lead-copper ore, 12,000 tons more than in 1952, although of slightly lower grade, and produced zinc concentrate containing about 32,500 tons of zinc, as well as 11,800 tons of copper concentrate containing some 2,900 tons of copper.

In the Mayo district of Yukon Territory the United Keno Hill Mines, Ltd., increased its milling rate 15 percent and in the year ended September 30, 1953, had milled 156,700 tons of ore to recover concentrates containing 6,252,000 ounces of silver, 13,700 tons of lead, and 10,600 tons of zinc. Ore reserves were increased 40 percent during the year to 612,900 tons averaging 38.4 ounces of silver, 9.1 percent lead, and 8.2 percent zinc.

The Mindamar Metals Corp., Ltd., deepened its Stirling zinc-lead-copper mine on Cape Breton Island, establishing 4 new levels, and treated 189,000 tons of ore to produce 7,700 tons of lead-copper concentrate containing 1,900 tons of lead and 820 tons of copper and zinc concentrate containing about 9,000 tons of zinc.

In New Brunswick the Brunswick Mining & Smelting Corp., Ltd., proceeded with development and construction on the company properties some 20 miles southwest of Bathurst. Two zinc-lead ore bodies estimated to contain 60 million tons of ore averaging 5.3 percent zinc, 1.7 percent lead, and about 0.5 percent copper were outlined to a depth of 1,000 feet. A 150-ton-per-day pilot mill was under construction near the Austin Brook ore body; eventual production was planned at the rate of 5,000 tons a day. Some distance north of Bathurst, Keymet Mines was building a 150-to 200-ton-per-day mill, while mine development went forward. Production was to begin about mid-1954.

During early 1953 a large deposit of copper-zinc-silver ore was discovered near Manitouwadge Lake. Geco Mines, Ltd., was formed to explore and develop the property, and trade journals [50] reported that initial drilling indicated several million tons of ore.

In Northwest Territories, the Pine Point Mines, Ltd. (operated by Consolidated Mining & Smelting Co. of Canada, Ltd., and Ventures, Ltd.), discontinued the exploratory drilling program at Pine Point, Great Slave Lake, in September, after indicating several million tons of ore averaging 10 percent combined lead and zinc. A large tonnage of relatively high grade ore was reported amenable to open-pit mining.

Greenland.—The Mestersvig lead-zinc deposit in East Greenland continued under active development by the Nordic Mining Co., Ltd., throughout 1953. According to the Danish press, the management planned to continue exploration throughout the winter of 1953–54 with a labor force of about 50 men. Work during the summer was primarily surface drilling, which was to be continued until

[50] Wall Street Journal, vol. 143, No. 37, Feb. 24, 1954, pp. 1, 14; Mining Journal (London), vol. 242, No. 6193, Apr. 30, 1954, p. 505; Eng. and Min. Jour., vol. 155, No. 2, Feb. 1954, p. 184.

more knowledge of the extent and value of the mineralization was obtained. The company notified the Danish Government, which owns 27.5 percent of the capital stock, that by the end of 1953 only 2.5 million ($368,000) of the original 15 million kroner ($2,210,000) capital would remain and that, if additional capital is not subscribed, the company must be prepared to discontinue its exploration, despite the considerable tonnage of lead-zinc ore proved to date. Mestersvig is 7 miles from docking facilities on a fjord normally ice-free only 4 to 5 weeks a year, which has, in some years, been icelocked throughout the year.

Mexico.—Mine production of zinc in Mexico was approximately the same as in 1952 (227,000 metric tons), and smelter output increased slightly to 53,000 tons, despite much lower zinc and lead prices. The remarkable uniformity in production is explained by the inflexibility of costs at the large Mexican mines. To reduce costs by closing mines or reduction of work force involves complicated legal and administrative problems, attended by heavy indemnity payments to the workers released. In consequence, production tends to be maintained, if company resources permit, without reference to market conditions. A number of small, marginal mines were kept in operation by a Government decree July 28, 1953, which provided a sliding-scale rebate of their production and export taxes. This rebate of up to 75 percent of the production and export taxes paid was applicable at the discretion of the Minister of Finance to producers whose production and export taxes did not exceed 200,000 pesos a month. Nonqualifying lead and zinc mines continued to pay the 2 taxes, which averaged well above 20 percent of their total export sales.

The American Smelting & Refining Co. operated its retort zinc smelter at Rosita, Coahuila, throughout the year, except for a short-lived strike in April and May. The company zinc-fuming plant at its Chihuahua lead smelter operated at approximate capacity to produce deleaded zinc fume, which was shipped to Rosita for reduction to metal. Operating mines in Mexico, owned or leased by the American Smelting & Refining Co.[51] and producing zinc ores, included the Charcas unit, San Luis Potosi; the Parral, Santa Barbara, Santa Eulalia, Montezuma Lead, and Plomosas units, Chihuahua; the Taxco unit, Guerrero; the Angangueo unit, Michoacan; and the Aurora-Xichu unit, Guanajuato. During 1953 the American Smelting & Refining Co. virtually completed construction of the mine plant, mill, power plant, and townsite at the Nuestra Senora lead-zinc-silver property, Cosalá, Sinaloa, which will produce and mill 12,000 tons of ore monthly. Exploration and development of the Rosario lead-zinc property, Rosario, Sinaloa, were continued, and design work for the mine and mill plant was in progress. Limited ore reserves remaining at the Angangueo unit, in combination with a disastrous fire at the Dolores mine, caused the company to apply to the Government to abandon the Angangueo operations, and the Michoacan Railway & Mining Co., Ltd., owner of the property, was notified that the lease would not be renewed after December 31, 1954.

The American Metal Co.,[52] through its Mexican subsidiary, Cia. Minera de Penóles, S. A., produced zinc concentrates at its Avalos

[51] American Smelting & Refining Co., Fifty-fifth Annual Report for the Year Ending Dec. 31, 1953.
[52] American Metal Company, Ltd., Annual Report for the 66th Year, 1953.

unit, Avalos, Zacatecas; Calabaza unit, Etzatlán, Jalisco; and Topia unit, Topia, Durango. The Topia unit completed its first full year of operations with satisfactory technical results. Company zinc concentrates were shipped to its Blackwell, Okla., smelter, but the lead concentrates produced at the same and some other mines were smelted at Torreón, Coahuila. Because of the zinc content of most Mexican lead concentrates smelted at Torreón, the company was considering plans to improve overall zinc and lead recovery by building a slag-fuming plant to treat current and accumulated lead-blast-furnace slags.

The San Francisco Mines of Mexico, Ltd., in the fiscal year ended September 30, 1953, milled 693,000 metric tons of ore to recover 67,000 tons of zinc concentrate (36,300 tons zinc content), 47,900 tons of lead concentrate (29,400 tons lead content), and 6,700 tons of copper concentrate (1,700 tons copper content). Ore reserves at the fiscal year end were 4,506,000 metric tons containing 9.06 percent zinc, 6.28 percent lead, 0.66 percent copper, and about 5.3 ounces of silver per ton.

Other large operations were those of the El Potosi Mining Co. (subsidiary of the Howe Sound Co.), which operated its 1,700-ton-per-day El Potosi mine, Chihuahua, without interruption throughout the year; and the Fresnillo Co., which operated its Fresnillo mine in Zacatecas to produce zinc, lead, and copper concentrates.

The new Waelz plant of Zinc Nacional, S. A., at Monterrey was put in operation in late 1953 to calcine purchased oxidized zinc ores from the Monterrey area.

Guatemala.—Compania Minera de Guatemala, S. A., erected a new 150-ton-per-day concentrator at its Coban mine in northern Guatemala and continued to operate, but the Compania Minera de Huehuetenango, S. A., was reported closed following a fire at the mill.

SOUTH AMERICA

Argentina.—Compania Minera Aguilar, S. A., a subsidiary of the St. Joseph Lead Co. in northern Argentina, produced 31,800 metric tons of zinc concentrate and 19,800 metric tons of lead concentrate compared with 30,400 and 23,100 tons, respectively, in 1952. Most of the zinc concentrate was shipped to Cia. Metalurgica Austral, S. A., Comodora Rivadavia, southern Argentina, for smelting in electrothermic furnaces.

Peru.—During 1953 the Cerro de Pasco Corp. further expanded its facilities for producing zinc, investing in excess of $9,000,000 for that purpose. The company 35-ton-per-day electrolytic plant at Oroya attained full capacity by year end, and the first 35-ton-per-day Sterling-process electrothermic unit was placed in production late in the year. A second Sterling unit was under construction, and plans called for completion of third and fourth units toward the end of 1955, with 2 more to be completed about a year later to give a total annual smelter capacity of 75,000 tons. New milling capacity at the Paragsha concentrator at Cerro de Pasco was put in operation during the year so that gains were made in the producing of zinc, lead, and copper. In all, 128,300 short tons of zinc concentrate was produced. Part of these concentrates contained about 58 percent zinc, but the

larger part contained about 49 percent zinc. At existing zinc prices the lower grade could not be sold for export because of high shipping and smelting charges on the recoverable zinc content. Of the total concentrate about 19,000 tons was treated in the electrolytic plant at Oroya, a small part was exported, and the balance was stocked awaiting a more favorable market or completion of Sterling electrothermal furnaces adapted to its treatment. Currently the recoverable zinc content of Cerro de Pasco concentrates was more than twice the lead being produced and almost three times that of copper. Lead-smelter production from the same mines totaled 26,800 tons, and in addition some 38,300 tons of lead was smelted from purchased ores.

A hundred miles south of Lima the Chavin Mines Corp. continued to develop its property and had by the end of 1953 developed 430,000 metric tons of ore containing 15.4 percent zinc, 9.1 percent lead, and 1.3 percent copper in a complex vein pattern. Consideration was being given to construction of a mill and a road to give access to the coast.

The Northern Peru Mining & Smelting Co. (American Smelting & Refining Co. subsidiary) Chilete mine near Pacasmayo was put into operation in May 1952 and throughout 1953 operated its 350-ton-capacity concentrator to produce about 400 tons of lead concentrate and 1,300 tons of zinc concentrate monthly.

EUROPE

Belgium and France.—During 1953 Belgian and French smelters produced about 274,000 metric tons of slab zinc, chiefly from concentrates produced in Belgian Congo (116,000 metric tons), French Africa (69,000), Sweden (47,000), Austria (73,000), and Spain (42,000), as well as Peru, Canada, and other countries. The smelters of Société des Mines et Fonderies de Zinc de la Vielle-Montagne produced 132,000 metric tons of slab zinc, as well as 34,700 tons of rolled zinc and 15,700 tons of zinc oxide. A special French nonferrous metals issue [53] of the Metal Bulletin (London) reviewed metal mining and smelting operations in France and the French Union, giving map locations of all important units. It also dealt with metal trading, controls, and consumption. No zinc has been mined in Belgium since 1946, when the Vedrin mine closed, but mines of European France yielded about 12,000 metric tons of zinc.

Finland.[54]—In the summer of 1952, Outokumpu Oy. began mining zinc at Metsämonttu, which was concentrated and exported to Belgium for refining. Outokumpu Oy. was preparing to exploit a zinc deposit at Lampinsaari, where 3,000,000 tons of 6-percent zinc ore has been established. Shaft sinking was in progress, and highway and rail facilities to the mine were in operation by December 1953. Production was scheduled for early 1954.

Germany, West.—Despite closings and curtailments at marginal mines, West German mine production of zinc increased 14 percent as a result of recent heavy investments in development and exploitation of zinc and lead ores. The major zinc- (and lead-) producing areas

[53] Metal Bulletin (London), Special French Nonferrous Issue: September 1953, pp. 7-25.
[54] Mining World and Engineering Record (London), Mining in Finland: Vol. 165, No. 4316, Dec. 19, 1953, p. 365.

of West Germany are the Harz Mountains, the Rhineland, and, to a lesser degree, southern Germany. In the Harz area the principal mines were the Erzbergwerk Rammelsberg and Erzbergwerk Grund. Rhineland mines included the important Auguste Viktoria, Ramsbeck, Maubacher Bleiberg, and Leuderich. Zinc and lead concentrates were also produced at the Segen Gettes and Schauinsland mines in southern Germany. During 1953 Germany imported almost 50,000 tons of zinc ores and concentrates, which, with those domestically produced, were smelted at 6 retort plants, 2 of which employed reflux refining columns of the New Jersey Zinc Co. type.

Italy.—Although Italy's smelter output of zinc increased almost 10 percent to 60,000 metric tons, mine production declined 10 percent to 102,000 tons. About 80 percent of the mine production came from Sardinia, where the Montevecchio deposits alone yielded about 36,000 tons of zinc concentrate. A second sink-float plant was being completed at Montevecchio at the year end, and a new lead-zinc flotation plant had been built by the SAPEZ Co. at Agruxau Mount mine, Sardinia, to increase its daily calamine-ore-mill capacity to 200–250 tons. The Italian zinc industry is unique in that a large share (approximately 20,000 tons) of mine and smelter output is based on oxidized ores (calamine) from mines in Sardinia and the Province of Bergamo. The calamine ores are successfully beneficiated by flotation [55] to recover 86 percent of the lead and 73 percent of the zinc content. The calamine concentrates were processed by the Monteponi Co. at its 8,000-ton annual capacity Cagliari electrolytic smelter and by the SAPEZ Co. at its 15,000-ton-capacity electrolytic smelter at Nossa.[56] Sulfide concentrates produced at Oreta, Premola Dassena, and Camerata Cornella, Sardinia, were reduced electrolytically by the Pertusola Co. of Croton (20,000-ton annual capacity), Montevecchio Co. of Venice (20,000-ton), and in a retort plant of the Monteponi Co. at Vado Ligure (12,000-ton).

Spain.—During 1953 the production of zinc concentrate in Spain totaled 150,000 metric tons (156,000 in 1952) and smelter output increased slightly to 22,900 tons. About 40,000 tons of crude concentrates was shipped to France and the United States, 15,600 tons of calcined concentrates to Norway and France, and 26,000 tons to the Netherlands. Chief mine production was in Santander Province, with minor production in Murcia, Lérida, Guipúzcoa and Gerona.

Sweden.—During 1953 Sweden produced almost 70,000 metric tons of zinc concentrate containing 41,500 tons of zinc. Producing companies were the Boliden Mining Co., the Government-owned AB Statsgruvor, Falu Kopparverk, and AB Zinkgrubor. Virtually all of Sweden's zinc concentrates were shipped to Belgium, German, and Norwegian reduction plants. In return, these countries supplied almost all of the 21,000 metric tons of slab zinc imported into Sweden in 1953.

United Kingdom.—Mine production totaled only 2,900 metric tons, but smelter production, based chiefly on imports of Australian ores, was 74,000 tons. Imports of metal, principally from Canada, Belgium,

[55] Rey, M., and Raffinot, P., La Flotation de calamine: Congres des Laveries des Mines Métalliques Française, Paris, September 1953.
[56] Straniero, Diego, Nossa's Unique Electrolytic Plant: Eng. and Min. Jour., vol. 155, No. 5, May 1954, pp. 68–72.

Australia, and the United States, totaled 130,000 tons, while consumption was 270,000 tons (including 76,000 tons of secondary). Exports of slab zinc were about 6,000 tons in 1953.

Major British industry news was the resumption of free trading on the London Metal Exchange January 2, 1953, and the disposal of excess Ministry of Materials zinc stock. At the beginning of 1953 total stocks of zinc in United Kingdom held by consumers and the Government totaled 166,000 in long tons as metal and 52,400 in concentrate. By the year end these quantities were reduced, respectively, to 27,700 and 45,300 tons, plus an undisclosed quantity in strategic stocks. During the year the market dropped from the official opening price of £110 per long ton (13.75 cents a pound) to an average of £74.3 in December (9.29 cents).

Yugoslavia.—In 1953 Yugoslavia produced 1,430,000 metric tons of lead-zinc ore (1,204,000 in 1952) to recover 94,500 metric tons of lead concentrate (92,100) and 71,400 tons of zinc concentrate (65,000). The grade of lead-zinc ore was becoming progressively poorer, but estimates placed the known reserves[57] at 18,000,000 metric tons containing 5 to 6 percent lead and 3 to 4 percent zinc. Approximately half of the reserves are in the Trepca mine and the remainder in such mines as Rudni, Zletovo, Mezica, Lesce, and Suplja Stena or Gradac. Most of the crude ore from the Trepca mines was milled at Svecan, and the Svecan lead smelter had capacity to refine 60,000 to 70,000 metric tons of lead a year, but the zinc concentrate had to be smelted elsewhere. Plans were being made to recover manganese, in the form of rhodochrosite, from the Trepca lead-zinc tailings at the Svecan mill.

A new flotation plant at the Gradac mines near Plevlja was put in operation in September 1953. Efforts were being made to increase smelting capacity, and new equipment was being installed at the 16,000-ton-capacity Celje retort smelter. The new 12,000-ton electrolytic zinc plant at Sabac, in construction in 1952, will when completed give Yugoslavia a total smelter capacity of 28,000 metric tons, a quantity exceeding present consumption of slab zinc by about 20,000 tons. Increased consumption is expected, however, when the zinc rolling mill at Sevojna and new steel plants are completed.

ASIA

Burma.—The Burma Corp., Ltd., operator of the Bawdwin silver-lead-zinc mine in the Shan States of northern Burma, continued to expand mine output and rehabilitate the mine and mill, as well as the lead smelter at Namtu. Since the mine was reopened in the summer of 1952, mine production has steadily increased and in 1953 totaled 58,500 tons. Ore was concentrated in the rebuilt Bawdwin mill, and in all about 3,900 metric tons of zinc and 8,000 tons of lead were produced in concentrate form. About 8,700 metric tons of lead and 580,000 troy ounces of silver were refined at Namtu during the year. The company plans to increase its rate of ore production further to about 300,000 tons a year, which is well below the 480,000 tons production in effect immediately before World War II. Reserves

[57] Zimmerman, Joseph, Yugoslavia's Lead and Zinc Industry: Daily Metal Reporter, vol. 53, No. 167, Aug. 27, 1953, pp. 1, 10.

at the Bawdwin mine were estimated in 1951 to be 2,736,000 long tons containing 12.5 percent zinc, 20 percent lead, and 15.5 ounces of silver per ton.

At Lough Keng, southeast of Taunggyi, Shan States, the Burmese Government was conducting exploratory operations on a large zinc deposit.

India.—The Metal Corp. of India, Ltd., is proceeding with its mining and development program at the Zawar lead-zinc mines 25 miles south of Udaipur, Rajasthan. Production data were not available; but output was believed to approximate that of 1952, when 3,900 long tons of 53-percent zinc concentrate and 2,000 tons of 72-percent lead concentrate were produced. The ore mined contained 7 percent zinc and 5 percent lead; and the deposit, according to the Department of Mines and Geology, Government of Rajasthan, is estimated to contain 1 million tons of high-grade, 2 million tons of medium-grade and 6 million to 8 million tons of low-grade ore.

Japan.—Mine and smelter output of zinc in Japan increased 20 and 14 percent, respectively, to establish new records of 104,700 metric tons of mine output and 80,100 tons of slab zinc. The quantities approximate Japanese requirements. During the year the Mitsui Metal Co. completed installing a 6,000-ton-annual-capacity vertical retort plant, and the Mitsubishi Metal Mining Co. installed a fluosolid roaster at one of its smelter. The Kosaka refinery of the Dowa Mining Co. is unique in that during 1953 it produced electrolytic zinc and copper from a single electrolyte.[58] The process was based on concentrate from the Hanaoka mine which contained 10 percent copper, 16 percent zinc, 22 percent iron, and 35 percent sulfur. The concentrate was processed in a Dorrco fluosolids reactor and the resulting calcine leached in tanks followed by countercurrent decantation washing. The solution, after filtration, passed to the copper tankhouse, where the copper was electrolytically deposited as 99.97 percent copper cathodes and 80 percent sponge copper. The electrolyte, which contains 10 percent zinc and about 0.1 percent copper, was neutralized with fine limestone, the gypsum resulting being separated by a battery of centrifuges. The solution was purified further by additions of limestone and manganese oxide, followed by filtration to remove iron. Zinc dust was used to precipitate the remaining copper, nickel, and cadmium, and beta naphthol precipitated the cobalt to prepare the solution for the electrolytic precipitation of 99.99-percent zinc.

AFRICA

Africa produced about 226,000 metric tons or 9 percent of the world mine output of zinc in 1953, an increase of 24 percent over 1952. The chief producing areas were Belgian Congo (126,000 metric tons), French Morocco (35,000 tons), Algeria (19,000 tons), Northern Rhodesia (16,000 tons), South-West Africa (16,000 tons), and Tunisia (4,000 tons).

Belgian Congo.—The first of two sections comprising the new 36,000-metric-ton-annual-capacity electrolytic zinc plant of Société

[58] Jessup, Alpheus W., How Dowa's Plant Extracts Cu-Zn From a Single Electrolyte: Eng. and Min. Jour., vol. 155, No. 1, January 1954, pp. 72-74.

Métallurgique du Katanga (Métalkat) was put in service June 1953, began production of slab zinc in late July, and had produced 7,800 metric tons by the end of 1953. All Congo zinc production continued to be from the rich copper-zinc ores of the Prince Leopold mine of Union Miniére du Haut Katanga at Kipushi. In all, 941,000 metric tons of ore was milled at the Kipushi concentrator to produce 242,000 tons (188,000 tons in 1952) of 52-percent zinc concentrate and 305,000 tons of 29-percent copper concentrate. About 75,000 tons of zinc concentrate was roasted at Jadotville to recover sulfuric acid necessary for the company hydrometallurgical treatment of oxidized copper-cobalt ores. Some 22,000 tons of roasted zinc concentrate was shipped to the Métalkat electrolytic plant at Kolwezi. Exports totaled 31,000 tons of roasted concentrate, 94,000 tons of unroasted concentrate and 5,800 tons of slab zinc.

French Africa.—The mine output of zinc in French Africa during 1953 totaled 58,300 metric tons and was made up as follows: Algeria, 19,200 tons; French Morocco, 35,500 tons; and Tunisia, 3,600 tons.

The principal zinc-producing mines of French Morocco were Bou Beker and Touissit lead-zinc mines of eastern Morocco, 25 miles south of Oudjda on the Algerian border. Together these mines supplied 94 percent of the zinc and 63 percent of the lead output of Morocco. The Bou Beker mine is immediately north of the Touissit mine, and together they occupy the center of a mineralized zone that extends 15 miles east-west across the border and 9 miles north-south. Total ore reserves have been estimated to contain 650,000 tons of zinc and 800,000 tons of lead. The Bou Beker mines, owned by Société des Mines Zellidja, were operated by Société Nord Africaine du Plomb, a subsidiary, of which Newmont Mining Corp. and St. Joseph Lead Co. own 49 percent. The crude ore contained 2.5 to 3 percent lead and about 5 percent zinc sulfide and zinc oxide and was concentrated in a modern 3,500-ton-per-day concentration plant of American design and manufacture. During the year the Zellidja mines produced 56,100 tons of 55-percent zinc concentrate and 43,000 tons of 75-percent lead concentrate by flotation.

The Touissit mines, operated by Compagnie Royale Asturienne des Mines, produced 4,400 metric tons of 46- to 51-percent zinc concentrate and 26,400 tons of 69-percent lead concentrate from ore containing about 6 percent lead and 5 percent zinc sulfide and zinc oxides. Other French Moroccan mines, including those of Société des Mines de l'Assifel Mal, Société Miniére des Gundafa, R. Duran, and Société Miniére des Rehamna, produced 4,100 tons of zinc concentrate and some 41,000 tons of lead concentrate. A new 100-ton daily capacity flotation mill was built at the Société Miniére des Gundafa mine at Toundout.

Across the border in Algeria, Société Nord Africaine du Plomb Zellidja mines produced ore containing 15 to 16 percent zinc and 1.5 percent lead, which was concentrated at the rate of 250 tons per day in a 1,000-ton-capacity gravity concentrator at Bou Beker.

The zinc concentrates from the Bou Beker, Touissit, and Zellidja's Algerian mines were shipped to the various smelters of Compagnie Royale Asturienne des Mines in Europe. Most of the Bou Beker and Société Nord Africaine du Plomb Zellidja lead concentrates were smelted at the Qued-el-Heimer Moroccan smelter, a Zellidja subsid-

iary in which Société Minière et Métallurgique de Pennarroya owns a 49-percent interest.

Tunisian zinc production in 1953 was 3,600 tons compared with 3,500 tons in 1952. Producing mines, listed in order of concentrate output, were the El-Akhouat, the Sakiet Sidi Youssef, and the Djebel Ressas. These mines and about 9 others produced 38,000 tons of lead concentrate containing 24,000 metric tons of lead.

Northern Rhodesia.—The Rhodesia Broken Hill Development Co., Ltd., established new records in mine and smelter output of zinc in 1953. The mine produced 188,400 short tons of 18-percent lead and 29-percent zinc ore, and production of lead and zinc concentrates was, respectively, 19,900 and 39,900 short tons. The electrolytic zinc-reduction plant, which was enlarged in 1952, produced 28,400 short tons of slab zinc during the year compared with 25,600 tons in 1952. The new company lead smelter was put into production in 1953 but owing to various difficulties operated intermittently and produced only 1,300 tons of lead. The old plant produced 11,600 tons of lead, chiefly in the Newman hearths. Ore reserves at the end of 1953 were reported to be 2,520,000 tons of ore containing 17.2 percent lead and 26.7 percent zinc.

New facilities to transfer concentrates from the narrow-gage to the broad-gage railway at Vsakos were completed during the year by South African Railways. The new concentrate[59] storage and shipping facilities at Walvis Bay rail terminal were completed and put in use in early 1953. They permit storage of 20,000 tons of lead, zinc, and copper concentrates and mechanical ship loading at the rate of 300 tons per hour.

The Tsumeb Corp. completed drilling the Hohewarte lead-zinc deposit, east of Windhoeck during the year, and the Del Africain Mining Co. was formed to exploit it when conditions are favorable.

South-West Africa.—The mine output of recoverable zinc increased slightly to 17,400 short tons, although the South-West-Africa Co. at Abenab closed its Berg-Aukas mine south of Grootfontein, which had been producing oxidized zinc ore. The company's Abenab West mine continued to produce, yielding about 7,000 tons of ore per month, from which lead, zinc, and vanadium were produced in concentrate form.

The Tsumeb Corp., Ltd., controlled by Newmont Mining Corp. and the American Metal Co., Ltd., continued to operate its Tsumeb lead-copper-zinc mine to produce a lead-copper concentrate and zinc concentrates, which when smelted yielded approximately 11,600 tons of zinc, 45,000 tons of lead, and 12,000 tons of copper. Sinking the 7-compartment, vertical De Wet shaft, which is to become the main operating shaft, continued, and by midyear it had reached a depth of 3,250 feet. Sinking will be continued to 4,150 feet, while the ore block between the 2,390-foot and 3,150-foot levels is being developed.

AUSTRALIA

Total mine production was essentially unchanged in 1953 at 204,200 metric tons, despite the closing of some marginal cost lead and zinc

[59] South African Mining and Engineering Journal, The Tsumeb Corp's. £400,000 Storage and Loading Installation Constructed at Walvis Bay: Vol. 64, No. 3137, part 1, p. 123.

producers in Western Australia. Price controls of both zinc and lead, established at A. £ 95 September 4, 1952, were abandoned by Queensland September 13, 1952, but remained in effect in the other five States until April 17, 1953. Thereafter both zinc and lead prices declined, reflecting the changes on the London Metal Exchange and elsewhere. The Commonwealth embargo on export of zinc and lead was removed at the end of March 1953.

The States and producing districts were New South Wales (Broken Hill and Captain's Flat districts), Queensland (Mount Isa field of Cloncurry district), and Tasmania (Read-Rosebery district).

In New South Wales the Consolidated Zinc Corp., Ltd., which operates the New Broken Hill Consolidated, Ltd., and the Zinc Corporation, Ltd., mines, milled 542,600 long tons (449,300 tons in 1952) to produce 108,400 tons (87,400) of zinc concentrate and 105,600 tons (77,200) of lead concentrates. Mill heads in 1953 averaged 15.4 percent lead (13.5 percent in 1952), 11.7 percent zinc (11.2), and 3.4 ounces of silver (3.1). The annual report of the Zinc Corp. reports reserves of 8,300,000 long tons of high-grade ore, with yet larger quantities indicated. Other producers in the Broken Hill district were North Broken Hill, Ltd., and Broken Hill South, Ltd.

Lake George Mining Corp., Ltd., operating its complex base-metals mine at Captain's Flat for the fiscal year ended June 30, 1953, milled 178,000 long tons as opposed to 180,000 tons in 1951–52. Metals contained in salable products were 14,300 tons of zinc, 8,200 tons of lead, 900 tons of copper, 183,400 ounces of silver, and 4,000 ounces of gold. Ore reserves of 1,600,000 tons contain 6.4 percent lead, 11.5 percent zinc, 0.62 percent copper, 1.39 ounces of silver, and 0.07 ounce of gold. The annual corporation report states that overall costs per ton of ore milled were A. £10.7 as compared with A. £4.3 in 1947.

Mount Isa Mines, Ltd., milled 623,800 long tons of 6.4-percent zinc and 7.4-percent lead ore in the fiscal year ending June 30, 1953, to recover 41,800 tons of 51.2-percent zinc concentrate and 115,700 tons of 33.8-percent lead concentrate. The lead concentrate is smelted at Mount Isa, but the zinc concentrate is exported. Estimated reserves of lead-zinc-silver ores at the end of the year totaled 9,880,000 tons containing 8.5 percent lead and 6.9 percent zinc and approximately 6 ounces of silver per ton. Diamond drilling in the area of the Northern Prospect indicated an excellent potential, while that below the lower limits of opencut mining showed increased values in lead, zinc, and silver at depth, which will require large-scale underground mining. A new ventilation shaft and air-conditioning plant was being installed.

The Electrolytic Zinc Co. of Australasia, Ltd., operated its Rosebery and Hercules mines and during the fiscal year milled 168,800 tons (162,600 tons in fiscal 1952) of ore averaging 18.0 percent zinc, 5.2 percent lead, 0.44 percent copper, and 6.45 ounces of silver and 0.09 ounce of gold per ton to recover 48,000 tons of 55.3-percent zinc concentrate, 9,300 tons of 58.6-percent lead concentrate, and 4,400 tons of 18.25-percent copper concentrate. The zinc concentrates were shipped to the company Risdon, Tasmania, electrolytic zinc plant, and the lead and copper concentrates were marketed in the United States. Ore reserves were reported at 2,000,000 tons of average grade. Work to increase mine and mill capacity at the west coast

operations (Rosebery and Hercules mines) from 160,000 tons to 250,000 annually was continued.

The Risdon electrolytic plant produced 87,400 long tons of refined zinc in the fiscal year ended in June and 91,600 metric tons in the calendar year 1953. About 25 percent of the production was from company concentrates and the remainder from Broken Hill. A portion of the zinc residues produced was shipped to the Broken Hill Associated Smelters, Pty., Ltd., at Port Pirie, South Australia, for the recovery of contained lead, silver and gold. The balance is stocked and will be re-treated in a plant that was being put in operation in the latter half of 1953.

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ZINC

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OF
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WESTERN MINING DEPARTMENT
PACIFIC NATIONAL LIFE BUILDING
SALT LAKE CITY, UTAH

A Chapter From MINERAL FACTS AND PROBLEMS

By O. M. Bishop and R. L. Mentch

UNITED STATES DEPARTMENT OF THE INTERIOR • Douglas McKay, Secretary

BUREAU OF MINES • J. J. Forbes, Director

This publication is a chapter from Bulletin 556, MINERAL FACTS AND PROBLEMS. The complete volume, covering all mineral commodities, may be purchased from the Superintendent of Documents, Washington 25, D. C., at a date to be announced later.

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ZINC

By
O. M. Bishop[1] and R. L. Mentch[1]

ZINC is a vitally important metal of the group forming the basic framework of modern industry. Its chief use is in preserving steel products and structures, but it is essential and irreplaceable in brass and finds extensive uses in die castings, photoengraving plates, and dry-cell battery cases. As zinc oxide it is used widely in vulcanizing rubber and paint formulas.

Summary

Zinc is one of the nonferrous metals consumed in large quantity. Although used in brass for about 2,000 years, only in the past 100 years or so has it attained additional usage for its own properties. Currently it finds extensive use in galvanizing, followed by die castings, brass, pigments, and rolled products.

The United States is the world's leading producer of zinc ores and its largest producer and consumer of zinc metal. During the past 30 years United States mines have produced one-third of all mine output, its smelters have reduced 40 percent of the world's zinc metal, and its industries have consumed 40 percent of the world's supply. In recent years, however, world mine production has increased markedly while that of the United States has remained relatively constant, annually averaging 629,000 tons—about 24 percent of world mine output in 1950–53.

World War II marked the beginning of United States dependence on imports for a large portion of its needs. For many years the United States had been a net exporter of zinc, but beginning in 1940 and continuing thereafter greatly increased domestic requirements necessitated importation of large tonnages of foreign metal, ores, and concentrates to augment home supplies. Return to self-sufficiency is unlikely.

Canada and Mexico are the second and third largest producers of zinc and historically the chief sources of imports to the United States. Other major producers of zinc on a mine basis in order of output in 1953 were U. S. S. R., Australia, Peru, Belgian Congo, Poland, Japan, Italy, West Germany, and Spain. Together with the United States these 11 countries furnished 87 percent of the total world mine production in 1953.

Total developed world reserves of measured and indicated zinc ore are estimated to contain in excess of 70 million tons of zinc, and in all probability the content of inferred ore reserves is from 2 to 3 times as large. Canada has the largest reserves on a national basis followed by Australia and the United States. Other countries having important reserves are Mexico, Peru, Argentina, Bolivia, Germany, Italy, Spain, Sweden, Poland, U. S. S. R., Algeria, French Morocco, Tunisia, Belgian Congo, Northern Rhodesia, South-West Africa, Burma, and Japan.

The various segments of the zinc industry in the United States—mining, smelting, secondary-recovery operations, fabricating, and marketing—are not

[1] Commodity-industry analyst, Bureau of Mines.

dominated to any marked degree by a few companies. The six largest producers on a mine basis supply less than half of the total United States output. Thirteen companies are engaged in primary reduction operations, and fabrication is controlled to a large extent by numerous independent companies.

World production of zinc in recent years (1948–54) has been well over world requirements, and consequently, large stocks have accumulated. Much of the excess production was shipped to the United States where accumulating stocks and the prospect of still more imports brought about unusually low prices and the closing of many mines. As a result, domestic mine production in 1954 declined to the lowest rate in about 20 years. In the second half of 1954 resumption of United States stockpiling and increased world consumption tended to alleviate the situation somewhat. One solution of the world problem of oversupply is increased consumption, with careful market research guiding any future production expansion programs; since consumption is stimulated by low zinc prices, efforts to improve extraction techniques and to lower costs per unit of output will help to solve this problem.

BACKGROUND

HISTORY OF ZINC INDUSTRY

Zinc has played a role in civilized man's activities from the time of Caesar Augustus, when brass, an alloy of copper and zinc, was discovered.

The demand for zinc, as for other metals, was greatly increased by the mechanization that characterized the industrial revolution. Uses for brass were multiplied and new uses for zinc and its compounds developed. In response to this demand world smelter production, which totaled only 50,000 tons in 1850, began doubling every 15 years to exceed 800,000 tons by 1910. Thereafter world production of zinc was spurred by strong demand, but at a lesser rate, until a high of 2,557,000 short tons was reached in 1953, or about triple that of 1910.

Before 1860 most of the small requirements of the United States were supplied by imports from England, Belgium, Germany, or Austria. The first recorded smelting of zinc in the United States was that by John Hitz at the Government Arsenal in Washington, D. C., in 1835–36. The ore was from Franklin, N. J., and the zinc metal produced was alloyed to make brass from which standard weights and measures were fabricated. In 1848 the Sussex Zinc & Copper Mining & Manufacturing Co., forerunner of The New Jersey Zinc Co., erected a small smelter at Newark. It was this smelter that first commercially produced zinc oxide directly from ore 4 years later.

In 1858 or 1859 the Lehigh Zinc Co. erected a Belgian-type furnace at Friedensville, Pa., and in 1860 J. Wharton built a similar plant at South Bethlehem, Pa. That same year the Matthiessen & Hegeler smelter was erected at La Salle, Ill., to smelt zinc ores from the Upper Mississippi Valley and southeast Missouri. Important zinc ore bodies had already been discovered in the Joplin area of southwest Missouri, but it was not until 1872 that the railway was completed permitting large shipments of these rich ores to La Salle. By 1860 the slab-zinc production of the Lehigh Zinc Co. had increased to 750 tons. In 1864 zinc was first used in the United States to coat steel. The demand for zinc-coated or galvanized products developed rapidly and aided in stimulating demand for zinc so that by 1880, 13 smelters were producing about 23,000 tons of slab zinc a year in all. Statistics of primary smelter production collected annually since 1882 show a strong, growing industry stimulated by the discovery of rich ore bodies and by the demand for zinc in galvanizing, brassmaking, and the rolling of sheet zinc. In 1890 primary slab-zinc production in the United States totaled 64,000 tons and 10 years later 124,000 tons.

The domestic smelting industry continued to grow, and in 1914 production of primary slab zinc from domestic and foreign ores totaled 353,000 tons. During World War I the demand for ammunition brass increased greatly. Furthermore Great Britain, which had obtained its zinc from Belgium and Germany, was forced to seek a new source. To meet this demand new smelting facilities were built in the United States at an unprecedented rate, and by 1917 primary slab production was 670,000 tons or 90 percent above the 1914 level. For the 5 years 1916–20 slightly over 60 percent of the world supply of slab zinc was produced in the United States.

Beginning with 1914 and continuing to the present zinc production in the United States at both mine and smelter levels has exceeded that of any other country.

SIZE, ORGANIZATION, PRODUCTION, AND PLANT LOCATION

Zinc is 1 of the 5 metals produced and used in greatest quantity by industrialized nations, both in war and peace. In the United States the output of primary zinc in all its forms in the decade 1941–50 approximately equaled the individual production of copper, aluminum, and lead and was about one-hundredth that of steel. In 1925–53 smelter production of primary slab zinc in the United States ranged from 207,000 to 942,000 short tons annually and averaged 646,000 tons. Smelter production for the world during the same years (see table 1) ranged from 861,000 to 2,557,000 tons annually and averaged 1,691,000 tons. In that 29-year period United States smelters produced 38 percent of the world supply of zinc. United States mine production in the same years ranged from about 19 to 48 percent of the world mine production and averaged about 32 percent.

TABLE 1.—*Comparison of zinc industry of the United States with world totals, 1925–1953* [1]

[All data in thousand short tons]

Year	Mine production			Smelter production (slab zinc)[2]			Consumption (slab zinc)[2]		
	Total	United States	Remainder of world	Total	United States	Remainder of world	Total	United States	Remainder of world
1925	1,471	711	760	1,249	573	676	1,323	538	785
1926	1,715	775	940	1,343	618	725	1,372	584	788
1927	1,748	719	1,029	1,440	593	847	1,454	550	904
1928	1,670	695	975	1,545	603	942	1,575	580	995
1929	1,793	724	1,069	1,599	625	974	1,614	596	1,018
1930	1,612	595	1,017	1,536	498	1,038	1,415	436	979
1931	1,220	410	810	1,099	292	807	1,159	315	844
1932	996	285	711	861	207	654	894	212	682
1933	1,250	384	866	1,083	307	776	1,123	346	777
1934	1,491	439	1,052	1,287	364	923	1,283	357	926
1935	1,600	518	1,082	1,467	421	1,046	1,504	477	1,027
1936	1,779	576	1,203	1,613	492	1,121	1,683	574	1,109
1937	1,933	626	1,307	1,789	557	1,232	1,805	614	1,191
1938	1,940	517	1,423	1,726	446	1,280	1,641	413	1,228
1939	1,962	584	1,378	1,818	507	1,311	(3)	[4] 576	(3)
1940	2,132	665	1,467	1,786	675	1,111	(3)	[4] 684	(3)
1941	2,314	749	1,565	1,928	822	1,106	(3)	[4] 767	(3)
1942	2,314	768	1,546	1,984	892	1,092	(3)	[4] 675	(3)
1943	2,224	744	1,480	2,028	942	1,086	(3)	[4] 769	(3)
1944	1,883	719	1,164	1,791	869	922	(3)	[4] 840	(3)
1945	1,664	614	1,050	1,404	765	639	(3)	[4] 803	(3)
1946	1,678	575	1,103	1,549	728	821	1,653	757	896
1947	1,819	638	1,181	1,758	802	956	1,782	727	1,055
1948	1,911	630	1,281	1,865	788	1,077	1,834	756	1,078
1949	2,105	593	1,512	2,012	815	1,197	1,780	657	1,123
1950	2,359	623	1,736	2,172	843	1,329	2,123	901	1,222
1951	2,535	681	1,854	2,315	882	1,433	2,217	886	1,331
1952	2,833	666	2,167	2,425	904	1,521	2,110	798	1,312
1953	2,844	547	2,297	2,557	916	1,641	2,299	936	1,363
Average	1,889	613	1,276	1,691	646	1,045	1,620	591	1,029

[1] SOURCES: National Security Resources Board, Materials Survey—Zinc, 1951; Yearbooks of American Bureau of Metal Statistics, and various Bureau of Mines data. It should be borne in mind that world-production data contain numerous estimates, that some nations report on a content basis, others are gaged by exports, while data for some are almost wholly estimated from incomplete information. Consumption data are also largely estimates.

[2] Primary metal only.

[3] Not available.

[4] Not included in average.

Zinc mineral deposits occur in economic quantity and are mined and smelted in many countries and on every continent. In 1953 no less than 21 countries each mined over 10,000 tons of zinc, and another 19 had smaller productions. The greatest concentration of mine production was in the United States, followed by Canada, Mexico, U. S. S. R., Australia, Peru, Belgian Congo, Poland, Japan, and Italy—each of which produced over 100,000 metric tons and all of which have smelting facilities. World mine and smelter output by countries is given in tables 2 and 3. In 1953 there were over 75 smelters and electrolytic reduction plants in 21 different countries; zinc-reduction plants in the United States and foreign countries are listed in tables 6 and 7.

The domestic zinc industry includes approximately 500 firms which mine domestic ores, import foreign ores, collect scrap, and smelt or otherwise process these raw materials into slab zinc, zinc pigments, dust, alloys or other primary zinc products for sale. This industry group can be broadly classified as mining companies, smelting companies (including secondary smelters), and fabricating companies.

TABLE 2.—*World mine production of zinc (content of ore),*[1] *by countries,*[2] *1944–48 (average) and 1949–53*[3]

[Metric tons]

Country [2]	1944–48 (average)	1949	1950	1951	1952	1953
North America:						
Canada	266, 616	261, 506	284, 153	309, 450	337, 291	362, 909
Guatemala	----------	(4)	332	6, 500	8, 200	6, 100
Honduras [5]	5	201	94	140	287	578
Mexico	188, 657	178, 402	223, 530	180, 064	227, 375	226, 538
United States [6]	576, 135	538, 142	565, 513	617, 961	604, 183	496, 618
South America:						
Argentina	15, 044	10, 921	12, 699	15, 475	15, 396	16, 089
Bolivia (exports)	18, 444	17, 666	19, 570	30, 535	35, 619	23, 974
Peru	59, 077	72, 037	87, 961	101, 300	127, 845	134, 127
Europe:						
Austria	2, 126	2, 694	2, 970	3, 355	4, 986	4, 378
Finland [7]	2, 200	2, 500	2, 100	3, 000	7, 000	3, 200
France	4, 389	10, 907	12, 178	13, 283	14, 600	[6] 12, 000
Germany, West	69, 565	57, 816	70, 153	75, 294	80, 680	91, 618
Greece	1, 170	3, 100	3, 184	6, 300	7, 300	7, 500
Ireland	----------	----------	762	2, 355	3, 124	(4)
Italy	38, 373	74, 562	87, 026	100, 733	112, 914	101, 540
Norway	4, 631	6, 603	5, 702	5, 469	5, 588	5, 000
Poland [8]	69, 930	85, 300	86, 200	86, 200	95, 300	110, 000
Spain [7]	38, 200	50, 000	64, 000	74, 000	86, 000	83, 000
Sweden	35, 148	35, 158	37, 121	38, 318	47, 162	41, 538
U. S. S. R.[7 8]	95, 800	110, 000	128, 800	148, 000	186, 000	212, 000
United Kingdom	2, 484	----------	36	194	1, 549	2, 891
Yugoslavia	21, 054	44, 017	38, 092	39, 420	47, 789	59, 970
Asia:						
Burma	----------	----------	----------	----------	750	3, 900
India [7]	----------	----------	300	1, 100	2, 000	2, 100
Indochina	357	----------	----------	----------	----------	----------
Iran	----------	----------	----------	----------	12, 000	5, 000
Japan	35, 712	44, 268	52, 032	64, 416	87, 468	104, 670
Korea, Republic of	2, 282	----------	----------	(4)	500	20
Philippines	----------	----------	50	150	1, 600	750
Thailand (Siam)	[9] 5	70	270	520	500	(4)
Turkey [7]	608	200	60	500	1, 200	(4)
Africa:						
Algeria	3, 961	6, 863	7, 167	9, 466	11, 192	19, 160
Angola	----------	----------	----------	350	40	100
Belgian Congo	33, 037	55, 420	74, 805	88, 705	98, 948	125, 791
Egypt	[10] 60	284	382	1, 432	886	200
French Equatorial Africa	224	44	621	518	377	----------
French Morocco	1, 470	2, 847	11, 412	19, 455	28, 352	35, 460
Nigeria	74	72	----------	----------	52	64
Northern Rhodesia [8]	18, 334	23, 217	23, 080	22, 953	23, 257	25, 737
South-West Africa	3, 197	12, 700	11, 300	14, 800	15, 600	15, 800
Tunisia	1, 630	3, 337	2, 932	3, 548	3, 540	3, 650
Australia	176, 652	184, 919	205, 632	197, 843	204, 380	[6] 204, 200
Total (estimate)	1, 788, 000	1, 910, 000	2, 140, 000	2, 300, 000	2, 570, 000	2, 580, 000

[1] Data derived in part from the Yearbook of the American Bureau of Metal Statistics, the United Nations Statistical Yearbook, and the Statistical Summary of the Mineral Industry (Colonial Geological Surveys, London).

[2] In addition to countries listed Bulgaria, Czechoslovakia, East Germany, North Korea, and Rumania also produce zinc, but production data are not available; estimates included in total.

[3] Compiled by Division of Foreign Activities for the Zinc chapter of Bureau of Mines Minerals Yearbook, 1953.

[4] Data not available; estimate included in total.

[5] United States imports.

[6] Recoverable.

[7] Estimated.

[8] Smelter production.

[9] Average for 1 year only, as 1948 was first year of production.

[10] Average for 1947–48.

TABLE 3.—*World smelter production of zinc, by countries, 1944–48 (average) and 1949–53* [1] [2]

[Metric tons]

Country	1944–48 (average)	1949	1950	1951	1952	1953
North America:						
Canada	165, 535	186, 920	185, 398	198, 290	201, 575	224, 715
Mexico	49, 057	53, 496	53, 492	58, 750	[3] 50, 387	[3] 53, 053
United States	717, 105	739, 154	765, 176	799, 800	820, 525	831, 072
South America:						
Argentina	1, 601	2, 651	[4] 7, 530	10, 629	10, 000	11, 600
Peru	1, 289	1, 261	1, 262	870	5, 216	8, 908
Europe:						
Belgium [5]	77, 325	176, 568	177, 326	200, 886	186, 799	193, 427
Czechoslovakia	[6] 2, 466	(7)	(7)	(7)	(7)	(7)
France	29, 015	58, 916	71, 531	74, 557	80, 064	80, 938
Germany:						
East	(7)	(7)	(7)	(7)	(7)	(7)
West	[6] 22, 983	86, 916	122, 796	[6] 140, 640	147, 216	148, 261
Italy	14, 534	26, 917	37, 925	47, 752	54, 851	60, 033
Netherlands	5, 447	15, 614	19, 752	22, 605	25, 905	25, 202
Norway	25, 559	41, 090	43, 173	40, 825	39, 232	37, 820
Poland	69, 930	85, 300	86, 200	86, 200	95, 300	110, 000
Rumania	[8] 2, 533	[4] 3, 200	3, 000	(7)	(7)	(7)
Spain	18, 792	19, 551	21, 264	21, 345	21, 358	22, 911
Sweden	944					
U. S. S. R. [4]	95, 800	110, 000	128, 800	148, 000	186, 000	212, 000
United Kingdom	68, 863	65, 144	71, 418	70, 851	69, 839	73, 875
Yugoslavia	4, 260	9, 903	12, 315	13, 223	14, 463	14, 549
Asia:						
China [4]	262	180	180	180	180	360
Indochina	[4] 125					
Japan	27, 520	32, 232	49, 008	56, 340	70, 032	80, 112
Africa:						
Belgian Congo						7, 801
Northern Rhodesia	18, 334	23, 217	23, 080	22, 953	23, 257	25, 737
Australia	79, 158	82, 255	84, 995	78, 246	88, 841	91, 625
Total (estimate)	1, 525, 000	1, 825, 000	1, 970, 000	2, 100, 000	2, 200, 000	2, 320, 000

[1] Data derived in part from the Yearbook of the American Bureau of Metal Statistics, the United Nations Monthly Bulletin and the Statistical Yearbook, and the Statistical Summary of the Mineral Industry (Colonial Geological Surveys, London).

[2] Compiled by Division of Foreign Activities for the Zinc chapter, Bureau of Mines Minerals Yearbook, 1953.

[3] In addition other zinc-bearing materials totaling 3,398 tons in 1952 and 27,477 in 1953.

[4] Estimate.

[5] Includes production from reclaimed scrap.

[6] 1945–48 average.

[7] Data not available; estimate included in total.

[8] 1946–48 average.

MINING

Domestic zinc-mining operations range from small enterprises by a single individual to large mines operated by corporations having more than one mining property and reduction plant. Mine production in 1952 came from approximately 600 mines operating in 22 States; 60 percent of these mines produced about 80 percent of the total output. Variations in size are evident from the fact that for that year the 6 leading mines supplied over 32 percent of the production and the 25 leading mines, 60 percent. In late 1952 and throughout 1953 many mines closed because of low zinc and lead prices, and by the end of 1953 the number of zinc-producing mines had decreased to approximately 400.

Most domestic zinc comes from mixed zinc and lead ores; the remainder is derived almost entirely from zinc and copper-zinc ores.

About two-thirds of the zinc-ore production normally comes from western mining districts or regions, chief of which are the Summit Valley (Butte) district, Montana; the Coeur d'Alene region, Idaho; the Warren (Bisbee) and Big Bug districts, Arizona; the Central and Magdalena districts, New Mexico; West Mountain (Bingham), Tintic, and Park City districts, Utah; Pioche district, Nevada; Red Cliff and Ten Mile districts, Colorado; and the Pend Oreille and Metaline districts, Washington.

Nearly all of the remaining ore production comes from five eastern or midwestern areas: Sussex County, N. J.; Mascot area, Tennessee; Austinville area, Virginia; St. Lawrence County, N. Y.; Upper Mississippi Valley area of southwestern Wisconsin and northwestern Illinois; and the Tri-State area of Missouri, Kansas, and Oklahoma. The Tri-State has been the largest

producing district for many years but was exceeded by the Coeur d'Alene region in 1950 and 1953 and by the Butte district in 1953. Indications are that the Butte district or Coeur d'Alene region will, within the next few years, regularly lead in annual production. The 50 foremost producing districts and areas are listed in table 4, in the order of their 1953

TABLE 4.—*Mine production of recoverable zinc in the United States by districts that produced 1,000 tons or more in any of the past 5 years, 1944–48 (average) and 1949–53*

[Short tons]

District	State	1944–48 (average)	1949	1950	1951	1952	1953
Summit Valley (Butte)	Montana	23, 337	47, 982	63, 511	80, 500	75, 968	75, 170
Coeur d'Alene region	Idaho	78, 748	74, 370	86, 103	74, 989	70, 316	68, 650
Tri-State (Joplin region)	Kansas, southwestern Missouri, Oklahoma.	132, 552	78, 628	80, 558	91, 553	90, 512	55, 729
St. Lawrence County	New York	32, 343	37, 973	38, 321	40, 051	32, 636	51, 529
New Jersey	New Jersey	75, 867	50, 984	55, 029	62, 917	59, 190	45, 700
Eastern Tennessee [1]	Tennessee	32, 001	29, 788	35, 326	38, 639	38, 020	38, 465
Upper Mississippi Valley	Northern Illinois, Iowa,[2] Wisconsin,	17, 208	17, 846	26, 793	31, 403	34, 716	26, 286
West Mountain (Bingham)	Utah	16, 787	22, 311	16, 120	18, 286	20, 395	19, 669
Red Cliff	Colorado	17, 293	17, 450	19, 956	29, 200	26, 000	16, 850
Austinville	Virginia	16, 766	13, 166	[1] 12, 396	[1] 7, 332	13, 409	16, 676
Central	New Mexico	37, 293	26, 376	26, 897	41, 884	48, 043	12, 743
Big Bug	Arizona	4, 955	8, 798	10, 416	9, 688	10, 862	10, 476
Upper San Miguel	Colorado	1, 960	6, 004	8, 881	9, 228	9, 811	10, 414
Kentucky-Southern Illinois	Kentucky, southern Illinois.	5, 768	6, 541	6, 642	9, 584	7, 968	5, 589
Park City region	Utah	9, 429	8, 359	7, 425	10, 209	7, 746	4, 848
Harshaw	Arizona	1, 945	2, 947	4, 193	4, 076	3, 924	4, 186
California (Leadville)	Colorado	6, 387	6, 455	7, 392	8, 144	8, 487	3, 945
Cochise	Arizona	2, 048	1, 760	1, 025	3, 243	4, 266	3, 893
Warm Springs	Idaho	2, 659	1, 653	1, 236	1, 860	2, 142	3, 026
Smelter (Lewis and Clark County).	Montana	6, 404	1, 463	2, 358	2, 428	2, 807	2, 924
Pioneer (Rico)	Colorado	3, 705	1, 354	1, 365	2, 527	2, 734	2, 634
Eureka (Bagdad)	Arizona	712	2, 304	1, 478	2, 504	3, 520	2, 594
Tintic	Utah	3, 547	6, 082	5, 985	3, 410	2, 951	2, 433
Aravaipa	Arizona	382	783	921	1, 404	1, 315	1, 732
Rush Valley and Smelter (Tooele County).	Utah	5, 901	2, 188	1, 219	1, 608	916	1, 528
Silver Bell	Arizona	46	1	11	--------	364	1, 324
Breckenridge	Colorado	720	362	427	366	620	1, 200
Warren (Bisbee)	Arizona	21, 747	35, 393	20, 707	4, 511	4, 791	1, 182
Verde (Jerome)	do	--------	4, 350	7, 800	10, 155	4, 360	959
Creede	Colorado	22	671	873	892	1, 024	858
Animas	do	1, 004	1, 029	961	1, 183	986	541
Magdalena	New Mexico	4, 172	2, 263	1, 677	2, 276	2, 122	512
Patagonia (Duquesne)	Arizona	688	555	368	601	1, 049	257
Pima (Sierritas, Papago, Twin Buttes).	do	4, 660	7, 177	5, 802	5, 414	3, 472	11
Chelan Lake [3] [4]	Washington	1, 902	2, 724	2, 430	1, 879	(5)	(5)
Coso [4]	California	1, 501	4, 062	5, 237	4, 720	5, 479	(5)
Flint Creek [4]	Montana	63	8	120	392	1, 084	(5)
Metaline [4]	Washington	8, 091	6, 496	11, 032	12, 753	(5)	(5)
Northport [4]	do	2, 139	1, 412	1, 304	3, 496	(5)	(5)
Ophir [4]	Utah	440	1, 004	374	341	670	(5)
Pioche [4]	Nevada	16, 659	18, 651	19, 655	14, 350	12, 493	(5)
Sneffels [4]	Colorado	477	1, 053	810	1, 094	931	(5)
Cow Creek (Ingot)	California	36	(5)	(5)	(5)	(5)	--------
Heddleston	Montana	1, 568	2, 026	892	1, 395	1, 066	--------
Old Hat (Oracle)	Arizona	3, 746	5, 195	4, 603	3, 583	3, 368	--------
Pioneer (Superior)	do	1, 229	--------	2, 595	6, 240	4, 175	--------
Smelter (Cascade County)	Montana	--------	1, 278	--------	--------	--------	--------
Ten Mile	Colorado	4, 208	9, 716	2, 925	16	12	--------
Tomichi	do	994	1, 456	963	1, 011	874	--------
Yellow Pine (Goodsprings)	Nevada	702	447	643	1, 332	1, 464	--------

[1] Includes very small quantity produced elsewhere in State.
[2] No production in Iowa since 1917.
[3] Includes Peshastin Creek and Wenatchee River districts.
[4] This district is not listed in order of 1953 output.
[5] Quantity withheld to avoid disclosure of individual company operations.

TABLE 5.—*Mine production of recoverable zinc in the United States, 1944–48 (average) and 1949–53, by States*

[Short tons]

State	1944–48 (average)	1949	1950	1951	1952	1953
Western States and Alaska:						
Alaska	9	2	6	1		
Arizona	44, 418	70, 658	60, 480	52, 999	47, 143	27, 530
California	7, 199	7, 209	7, 551	9, 602	9, 419	5, 358
Colorado	39, 157	47, 703	45, 776	55, 714	53, 203	37, 809
Idaho	83, 135	76, 555	87, 890	78, 121	74, 317	72, 153
Montana	35, 015	54, 195	67, 678	85, 551	82, 185	80, 271
Nevada	20, 413	20, 443	21, 606	17, 443	15, 357	5, 812
New Mexico	42, 546	29, 346	29, 263	45, 419	50, 975	13, 373
Oregon		6	21	3	1	
South Dakota	21					
Texas	13			24	3	
Utah	37, 216	40, 670	31, 678	34, 317	32, 947	29, 184
Washington	12, 273	10, 740	14, 807	18, 189	20, 102	32, 786
Total	321, 415	357, 527	366, 756	397, 383	385, 652	304, 276
West Central States:						
Arkansas	91	1	8	50	26	
Kansas	47, 375	29, 433	27, 176	28, 904	25, 482	15, 515
Missouri	20, 914	5, 911	8, 189	11, 476	13, 986	9, 981
Oklahoma	65, 037	44, 033	46, 739	53, 450	54, 916	33, 413
Total	133, 417	79, 378	82, 112	93, 880	94, 410	58, 909
States east of the Mississippi River:						
Illinois	9, 485	18, 157	26, 982	21, 776	18, 816	14, 556
Kentucky	397	935	731	3, 457	3, 280	489
New Jersey	75, 867	50, 984	55, 029	62, 917	59, 190	45, 700
New York	32, 343	37, 973	38, 321	40, 051	32, 636	51, 529
Tennessee	32, 001	29, 788	35, 326	38, 639	38, 020	38, 465
Virginia	17, 063	13, 166	12, 396	7, 332	13, 409	16, 676
Wisconsin	13, 095	5, 295	5, 722	15, 754	20, 588	16, 830
Total	180, 251	156, 298	174, 507	189, 926	185, 939	184, 245
Grand total	635, 083	593, 203	623, 375	681, 189	666, 001	547, 430

production, and the mine production of recoverable zinc, by States, in recent years, is given in table 5.

All ores, with some minor exceptions, are milled near the mines to produce concentrates for shipment to the smelters.

SMELTING

The United States zinc-smelting industry consists of 18 primary reduction plants and 12 secondary distilling plants that produce slab zinc. Most of the primary smelting plants are integrated with producing mines that directly supply zinc concentrate. The primary plants also operate as custom smelters, buying concentrates and ores from foreign and domestic mines and selling the resulting slab zinc, zinc dust, or pigment on the market. Such smelters also smelt on a toll or fee basis by which ownership of the raw material and the product remains with the shipper. In addition to ores and concentrates these plants treat some scrap materials. The 18 primary reduction plants in 1953 had a capacity of 1,089,000 tons of slab zinc. They actually operated at only 86 percent of that capacity, producing 916,000 tons of primary slab zinc and 18,000 tons of secondary redistilled zinc in 1953, a total of 934,000 tons. In addition to the 934,000 tons of slab zinc produced at primary smelters, 35,000 tons were produced by redistillation of zinc scrap at secondary smelters that treat only that material. Several primary smelters also produce zinc oxide, leaded zinc oxide, and lithopone, and one company produced a substantial tonnage of zinc dust. Still another important product of many primary smelters is sulfuric acid, which is made from the sulfur dioxide gas produced in roasting sulfide zinc ores.

Table 6, which lists domestic smelters and locations, subdivides the 18 primary smelters into groups based upon the method of reduction and gives the annual slab-zinc capacity of

each group. The 5 electrolytic plants had 36 percent, the 9 horizontal retort plants 36 percent, the 4 vertical retort plants 23 percent, and the 13 secondary distillation plants 5 percent of the total industry capacity for slab zinc as of the end of 1953. Table 7 lists known foreign zinc-reduction plants by location, type, and capacity.

TABLE 6.—*United States zinc smelters: Their location and group capacity for slab zinc, in 1953*

[Short tons]

ELECTROLYTIC PLANTS	
American Smelting & Refining Co.	Corpus Christi, Tex.
American Zinc Co. of Illinois.	Monsanto, Ill.
Anaconda Copper Mining Co.	Anaconda, Mont.
Do	Great Falls, Mont.
Sullivan Mining Co	Kellogg, Idaho.
Total capacity	412, 500 tons
HORIZONTAL-RETORT SMELTERS	
American Smelting & Refining Co.	Amarillo, Tex.
United States Steel Corp. (American Steel & Wire Div.)	Donora, Pa.
American Zinc Co. of Illinois.	Fairmont City, Ill.
Do	Dumas, Tex.
Athletic Mining & Smelting Co.	Fort Smith, Ark.
Blackwell Zinc Co	Blackwell, Okla.

TABLE 6.—*United States zinc smelters: Their location and group capacity for slab zinc, in 1953*—Continued

[Short tons]

HORIZONTAL-RETORT SMELTERS—Con.	
Eagle-Picher Co. (Mining and Smelting Div.)	Henryetta, Okla.
Matthiessen & Hegeler Zinc Co.	La Salle, Ill.
National Zinc Co., Inc	Bartlesville, Okla.
Total capacity	416, 500 tons
VERTICAL-RETORT SMELTERS	
Meadowbrook Corp	Meadowbrook, W. Va.
New Jersey Zinc Co	Depue, Ill.
New Jersey Zinc Co. of Pa	Palmerton, Pa.
St. Joseph Lead Co	Josephtown, Pa.
Total capacity	260, 000 tons
SECONDARY SMELTERS	
American Smelting & Refining Co.	Los Angeles, Calif.
Do	Beckemeyer, Ill.
Do	Sand Springs, Okla.
Do	Trenton, N. J.
American Zinc, Lead & Smelting Co.	Hillsboro, Ill.
Bullock, W. J., Inc	Fairfield, Ala.
General Smelting Co	Philadelphia, Pa.
Nassau Smelting & Refining Co., Inc.	Tottenville, N. Y.
Pacific Smelting Co	Torrance, Calif.
Sandoval Zinc Co	Sandoval, Ill.
Superior Zinc Corp	Bristol, Pa.
Wheeling Steel Corp	Wheeling, W. Va.
Total capacity	58, 000 tons
Total slab-zinc capacity	1, 147, 000 tons

TABLE 7.—*Foreign zinc-smelter capacity, 1953* [1]

ELECTROLYTIC PLANTS

Location	Company	Estimated annual capacity for slab zinc (short tons)
Argentina: Zarate	"Meteor" Est. Met. S. A. I.yC	6, 600
Australia: Risdon, Tasmania	Electrolytic Zinc Co. of Australasia	114, 200
Belgian Congo: Kolwezi	Soc. Métallurgique de Katanga	39, 700
Belgium: Baelen	Soc. Anon. de la Vieille Montagne	41, 900
Canada:		
Trail, B. C	Consolidated Mining & Smelting Co	190, 000
Flin Flon, Manitoba	Hudson Bay Mining & Smelting Co., Ltd	69, 350
France: Viviez, Aveyron	Soc. Anon. de la Vieille Montagne	49, 600
Italy:		
Monteponi, Sardinia	Soc. di Monteponi	9, 900
Crotone	Soc. Min. e Met. di Pertusola	25, 400
Nossa, Bergamo	S. A. P. E. Z. Soc. per Azioni Piombo e Zinco	19, 800
Porto Marghera	Montevecchio Soc. Italiana del Piombo e dello Zinco	26, 500
Japan:		
Kosaka, Akita-ken	Dowa Mining Co. Ltd	4, 000
Hosokura	Mitsubishi Metal Mining Co. Ltd	13, 200
Naoshima	do	3, 700
Kamioka	Mitsui Mining & Smelting Co. Ltd	15, 900
Miike	do	8, 600
Aizu	Nihon Soda K. K	11, 200
Annaka	Toho Aen Kogyo K. K	13, 200
Northern Rhodesia: Broken Hill (Sable).	Rhodesia Broken Hill Dev. Co	30, 200
Norway: Eitrheim	Det Norske Zinkkompani, A. S	46, 300

See footnotes at end of table.

TABLE 7.—*Foreign zinc-smelter capacity, 1953* [1]—Continued

ELECTROLYTIC PLANTS—continued

Location	Company	Estimated annual capacity for slab zinc (short tons)
Peru	Cerro de Pasco Corp	13, 000
U. S. S. R.:		
Dzhaudzhukau (Caucasus)	State-owned	44, 100
Chelyiabinsk (Urals)	do	44, 100
Total		840, 000

RETORT PLANTS

Location	Company	Estimated annual capacity for slab zinc (short tons)
Argentina: Comodoro Rivadavia	Cia. Metalúrgica Austral S. A	17, 600
Belgium:		
Corphalie	Cie. des Métaux d'Overpelt-Lommel et de Corphalie	39, 700
Overpelt	do	39, 700
Lommel	do	39, 700
Prayon-lez-Trooz and Engis	Soc. Anon. Métallurgique de Prayon	60, 600
Rothem	Soc. Anon. de Rothem	33, 100
Angleur	Soc. Anon. de la Vieille Montagne	28, 700
Flone	do	52, 900
Valentin-Cocq	do	28, 700
Czechoslovakia:		
Kutterschitz	State-owned	16, 500
Settenz	do	8, 800
France:		
Noyelles-Godault (Pas de Calais)	Soc. Minière et Métallurgique de Peñarroya	16, 500
Creil, Seine-et-Oise	Soc. Anon. de la Vieille Montagne	11, 000
Auby (Nord)	Cie. Royale Asturienne des Mines	41, 900
Mortagne (Nord)	do	9, 400
Federal Republic of Germany:		
Münsterbusch	Stolberger Zink A. G. f. Bergbau u. Zinkhüttenbetrieb	35, 300
Nievenheim	do	18, 700
Friedrich-August Hütte, Post Nordenham.	Metallwerke Unterweser A.-G	26, 500
Borbeck	A.-G. des Altenbergs f. Bergbau u. Zinkhüttenbetrieb	33, 100
Duisburg-Wanheim	"Berzelius" Metalhütten G.m.b.H	36, 400
Harlingerode (Oker)	Unterharzer Berg-u. Hüttenwerke G.m.b.H.	55, 100
Italy: Vado Ligure	Soc. di Monteponi	13, 200
Japan:		
Omuda (Miike Wks.)	Mitsui Mining & Smelting Co	26, 800
Shimonoseki (Hikoshima Wks.)	do	18, 500
Mexico: Rosita, Coah	American Smelting & Refining Co. (Mexican Zinc Co.)	60, 000
Netherlands: Budel	Zincs de la Campine	54, 000
Poland:		
Welnowiec	Hohenlohe Werke	19, 800
Lipiny	Slaskie Kopalnie i Cynkownie	70, 500
Bogucice	do	
Nowy-Bytom	do	
Wirek	do	
Buchacs	do	
Szopienice and Trzebinia	Giesche Spólka Akcyjna	94, 800
Zagorze	Soc. des Charbonnages, Mines et Usines de Sosnowice (Pauline Hütte).	6, 100
Chropaczow	Dyrekcja Kopain i Hut Ksiecia Donnersmarcka	8, 500
Spain:		
Arnao	Cie. Royale Asturienne des Mines	30, 900
Peñarroya (Prov. de Córdoba)	Soc. Minière et Métallurgique de Peñarroya	8, 300
United Kingdom: Avonmouth and Swansea, South Wales.	Imperial Smelting Corp. Ltd. (National Smelting Co. Ltd.).	88, 200
Yugoslavia: Celje	State-owned	17, 600
U. S. S. R.:		
Leninogorsk (Kazakhstan)	State-owned	165, 000
Belovo (Kousbas)	do	27, 500
Konstantinovka (Ukraine)	do	13, 000
Ust Kamenogorsk (Kazakhstan)	do	Not known, reportedly important.
Total		1, 373, 000

[1] SOURCE: Yearbook of the American Bureau of Metal Statistics, 1953 and Minerais et Métaux Société Anonyme, 1953.

The plants treating secondary-zinc-bearing materials include zinc smelters, remelters, brass mills, alloy manufacturers, and chemical and pigments plants. Secondary zinc reported by the Bureau of Mines is that recovered from old and new scrap. Old zinc scrap consists of metal articles discarded because of wear, damage, or obsolescence, usually after use. New scrap is that generated during the manufacture of articles for ultimate consumption but is limited to the scrap processed for recovery of its metal content elsewhere than at the plant of generation. In other words, new scrap as reported by the Bureau of Mines excludes home scrap and is predominently galvanizers' dross, skimmings and ashes, die-cast skimmings, chemical residues, flue dust, sal skimmings, and metal clippings. Old scrap includes old brass, die castings, and engravers' plates. Secondary zinc recovered in 1925 through 1953 had a range of 75,000 to 368,000 tons annually and averaged 223,000 tons. In 1946–53 the average had increased to 302,000 tons or 23 percent of total supply. Recovery in brass and bronze constitutes the most important form of recovery, averaging well over 50 percent of the total in 1940–53. Zinc recovered in slab form and as zinc dust was about 25 percent of the total, and recovery in alloys, pigments, and chemicals comprised the remainder. Production by form of recovery and the kind of scrap processed in 1952 and 1953 is given in table 10. The annual recovery of secondary zinc in all forms from 1925 through 1953 is shown as an element of supply in table 12.

In addition to the zinc pigments and chemicals produced at primary and secondary smelters, considerable quantities of zinc oxide, leaded-zinc oxide, lithopone, zinc sulfate, and zinc chloride are produced by chemical and pigment manufacturers from zinc ores or zinc scrap. The zinc content of all pigments and salts made from either ores or secondary material totaled 159,000 tons in 1952 and 176,000 tons in 1953. Ores and concentrates were the chief raw material, supplying 109,000 and 118,000 tons of the zinc content of the chemicals and pigments made in 1952 and 1953, respectively.

Leadership in the United States smelting industry is largely vested in companies that combine substantial mine production with large, well-located reduction plants. One such concern, the Anaconda Copper Mining Co., produces about one-quarter of the slab zinc smelted in the United States. This firm not only treats company-mined ores but processes custom ores from other mines in two electrolytic plants at Anaconda and Great Falls, Mont. The St. Joseph Lead Co. and The New Jersey Zinc Co. hold dominant positions in the East, smelting both company-mined and purchased ores, while the American Zinc, Lead & Smelting Co. and the Eagle-Picher Co. are important factors in the mid-continent area. Other smelting firms exerting influence in production and marketing practice throughout the United States are the Matthiessen & Hegeler Zinc Co., the American Metal Co., the American Smelting & Refining Co., and the National Zinc Co.

Smelters are established on good routes of transportation, usually at some point near a source of cheap fuel and between the raw-material sources and the market. Electrolytic plants—requiring, as they do, about 4,000 kw.-hr. of power per ton of zinc reduced, are located in part to secure favorable power rates. Similarly, retort smelters, fired by natural gas, are situated on the basis of a plentiful supply of that cheap fuel and coal-fired smelters on the basis of adequate cheap and suitable coals. The marketing of byproduct sulfuric acid is yet another factor in plant location.

The interrelationship of these various factors has resulted in concentration of 91 percent of the primary slab-zinc capacity in Pennsylvania, Montana, Oklahoma, Illinois, and Texas, with Idaho, Arkansas, and West Virginia making up the remaining 9 percent. Table 8 shows the production of primary slab zinc by States from 1944–53 and table 9 production of slab zinc according to methods of reduction and grades.

TABLE 8.—*Primary slab zinc produced in the United States, by States where smelted, 1944–48 (average) and 1949–53*

[Short tons]

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Texas and West Virginia [1]	Total	
								Short tons	Value
1944–48 (aver.)	22, 441	37, 674	118, 138	199, 095	116, 769	190, 127	106, 233	790, 477	$158, 481, 977
1949	17, 116	41, 854	86, 823	216, 578	157, 650	156, 920	137, 841	814, 782	202, 391, 849
1950	20, 688	53, 922	108, 301	216, 104	145, 117	162, 539	136, 796	843, 467	240, 050, 708
1951	21, 776	54, 468	108, 544	208, 482	161, 247	189, 177	137, 939	881, 633	321, 619, 718
1952	21, 644	54, 340	115, 331	214, 980	161, 242	193, 811	143, 131	904, 479	300, 829, 715
1953	20, 379	54, 037	129, 904	222, 354	134, 918	192, 279	162, 234	916, 105	210, 154, 487

[1] Includes Missouri, 1944 and 1947–53.

TABLE 9.—*Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1944–48 (average) and 1949–53*

[Short tons]

CLASSIFIED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled	Redistilled secondary		Total
			At primary smelters	At secondary smelters	
1944–48 (average)	295, 321	495, 156	22, 890	30, 041	843, 408
1949	326, 152	488, 630	22, 782	32, 259	869, 823
1950	342, 085	501, 382	28, 411	38, 559	910, 437
1951	336, 087	545, 546	16, 251	32, 406	930, 290
1952	351, 106	553, 373	18, 861	36, 250	959, 590
1953	370, 870	545, 235	17, 645	35, 230	968, 980

CLASSIFIED ACCORDING TO GRADE

Year	Grade A		Grade B	Grades C and D		Grade E	Total
	Special High-Grade (99.99 percent Zn)	High-Grade (Ordinary (99.90 percent Zn)	Intermediate (99.50 percent Zn)	Brass Special (99.00 percent Zn)	Select (98.75 percent Zn)	Prime Western (98.50 percent Zn)	
1944–48 (average)	239, 051	202, 102	42, 607	62, 498	14, 605	282, 545	843, 408
1949	230, 576	206, 651	21, 513	56, 388	2, 565	352, 130	869, 823
1950	271, 678	192, 075	21, 571	46, 730	4, 021	374, 362	910, 437
1951	281, 571	175, 499	20, 734	60, 511	13, 494	378, 481	930, 290
1952	295, 801	182, 125	17, 903	48, 817	13, 608	401, 336	959, 590
1953	312, 810	180, 188	14, 720	56, 219	1, 930	403, 113	968, 980

TABLE 10.—*Zinc recovered from scrap processed in the United States, 1952–53*

[Short tons]

Recoverable zinc content of scrap processed			Zinc recovered [1] from scrap processed		
Kind of scrap	1952	1953	Form of recovery	1952	1953
New scrap:			As metal:		
Zinc-base	108, 273	110, 774	By distillation:		
Copper-base	126, 625	117, 611	Slab zinc	54, 560	50, 344
Aluminum-base	820	1, 985	Zinc dust	22, 292	22, 185
Magnesium-base	40	73	By remelting	6, 275	6, 116
Total	235, 758	230, 443	Total	83, 127	78, 645
Old scrap:			In zinc-base alloys	9, 875	8, 535
Zinc-base	24, 997	19, 622	In brass and bronze	184, 935	168, 951
Copper-base	49, 312	42, 888	In aluminum-base alloys	1, 120	3, 673
Aluminum-base	226	1, 604	In magnesium-base alloys	161	194
Magnesium-base	130	121	In chemical products:		
			Zinc oxide (lead-free)	8, 914	11, 430
Total	74, 665	64, 235	Zinc sulfate	3, 871	4, 566
			Zinc chloride	10, 794	12, 981
Grand total	310, 423	294, 678	Lithopone	6, 922	5, 008
			Miscellaneous	704	695
			Total	227, 296	216, 033
			Grand total	310, 423	294, 678

[1] Zinc content.

FABRICATION

About 40 percent of the slab zinc produced by smelters is used without fabrication in galvanizing iron and steel products, chiefly at the plants of steel producers; thus galvanizing is largely concentrated in such iron- and steel-producing States as Ohio, Pennsylvania, Illinois, Indiana, Maryland, and Alabama. Somewhat less than 5 percent of the zinc consumed in galvanizing is cast into anodes for electro-galvanizing.

The second largest use of zinc is in the manufacture of zinc-base alloys. Much of the alloy is made by alloyers, but the remainder is made at the die-casting plants. Since the automobile, home-appliance, and office-machine industries are the largest consumers of zinc-base alloys the consumption is largely concentrated in the manufacturing areas of Ohio, Michigan, Wisconsin, New York, Pennsylvania, and California.

The brass industry, the third most important consumer of zinc, is heavily concentrated in the Connecticut Valley, but Michigan, Illinois, and Ohio are important manufacturing areas for brass and consume large quantities of zinc in making the alloy.

Zinc rolling mills—largely concentrated in Illinois, Indiana, Pennsylvania, and New York—annually roll 50,000 to 90,000 tons of slab zinc to produce zinc plate, sheet, ribbon, foil, rod, and wire.

PRODUCTION AND CONSUMPTION TRENDS

Zinc supplies throughout the world slightly exceed total requirements at present. Even in 1951, when demand exceeded zinc supply, the actual consumption in the United States was well below the total supply level, and the shortage was felt by the consuming industries only because large shipments of metal were being withdrawn from the market for the National Stockpile. The emergency stocking of zinc beyond consumers' requirements in Great Britain further aggravated the apparent shortage. In early 1952 the true situation of adequate or excess supplies became apparent. Foreign imports of both ores and concentrates were available in greater quantity, smelter stocks of unsold zinc increased, and United States market prices fell well below the 19.50 cents a pound ceiling to average 16.21 cents in 1952, 10.86 cents in 1953, and 10.68 cents in 1954.

An analysis of the situation (see table 1, p. 4) indicates that the depressed market and excess stocks in the United States were brought about by world production of zinc over world requirements and the consequent flow of ores and metal to United States markets. Although world consumption of primary slab zinc averaged 1,975,000 tons annually in 1946–53 and had increased 39 percent, world output of slab zinc in the same years averaged 2,042,000 tons and had increased 65 percent. As a result stocks accumulated to depress the price. The fact that much of the foreign production is from large, high-grade deposits is a distinct advantage to foreign producers in competing in the United States zinc market against production from domestic mines in which costs are high and ore bodies relatively low grade. Details of domestic mine costs and ore grade for 1952 were published by the Tariff Commission (*32*),[1] and it was noted that although average labor costs per ton of ore are lower in the United States than in Canada or Mexico, the average Canadian and Mexican ores contain a greater value in metal and hence the cost per unit of metal produced is less.

In response to the lower prices beginning in mid-1952 mine production of recoverable zinc in the United States dropped from an annual rate of 720,000 tons during the first half of 1952 to an annual rate of 610,000 tons in the latter half of the year. Production dropped further to 547,000 tons in 1953, to 240,000 tons in the first 6 months of 1954, and to 464,000 tons for all of 1954. Purchases of newly mined domestic zinc by the United States Government beginning in June 1954 brought about a considerable reduction in domestic smelter stocks and have resulted in a 15-percent increase in the price of zinc.

Consumption of slab zinc declined from 986,000 tons in 1953 to 876,000 tons in 1954. In the last 3 months of 1954, however, consumption totaled 244,000 tons or an annual rate of approximately 975,000 tons.

TECHNOLOGY

ECONOMIC GEOLOGY OF ZINC

Zinc ores are aggregates of minerals, one or more of which contains zinc in economic quantity. The most common zinc mineral is sphalerite or zinc blende (ZnS), which, with its oxidation products smithsonite ($ZnCO_3$) and hemimorphite ($(ZnOH)_2SiO_3$), forms the chief zinc minerals of the world. Zincite (ZnO), willemite (Zn_2SiO_4), and franklinite ($(Fe, Zn, Mn)O: (Fe, Mn)_2O_3$) occur in a unique and very important zinc deposit at Ogdensburg, N. J., but apart from this one occurrence have little economic importance.

Sphalerite almost always occurs in association with galena, the sulfide of lead. It may also be associated with copper or other base-metal sulfides or occur alone.

[1] Italicized figures in parentheses refer to items in the bibliography at the end of this chapter.

Most zinc ores occur as cavity fillings and replacements deposited by hydrothermal solutions, considered to be of igneous origin (*4*). They commonly occur in limestones and dolomites but also occur in important amounts in other rock types at many mines, including those of Butte, Mont.; the Coeur d'Alene, Idaho; Ogdensburg, N. J.; Cerro de Pasco, Peru; the Rammelsberg deposits, Germany; and the Broken Hill lode, Australia.

Although contact metasomatic deposits such as the one at Hanover, N. Mex., are locally important, they are uncommon and usually small. The principal classes of zinc deposits, with some examples of each follow:

1. Contact metasomatic: (Hanover, N. Mex.; Long Lake, Ontario).
2. Cavity fillings:
   (*a*) Fissure veins (San Juan County, Colo.)
   (*b*) Breccia (Jefferson City and Mascot, Tenn.; Austinville, Va.)
   (*c*) Cave fillings (Mississippi Valley area)
   (*d*) Pitches and flats (Upper Mississippi Valley)
3. Replacements:
   (*a*) Massive (Leadville, Colo.; Bingham and Tintic, Utah; Sullivan mine, British Columbia; Santa Eulalia, Chihuahua, Mexico; Trepca, Yugoslavia)
   (*b*) Replacement lodes (Park City, Utah; Coeur d'Alene, Idaho; Franklin Furnace, N. J.; Broken Hill, Australia; Edwards, Balmat, N. Y.)
   (*c*) Disseminated (Tri-State district)
4. Surficial oxidation (residual hemimorphite and smithsonite in Virginia, Tennessee, Arkansas, and Missouri)

In general terms prospecting is the search for ore, while exploration is the work done to get data on the size, shape, location, and quality of an ore body. Early prospecting and exploration were confined to examination of rock outcrops in the search for gold, silver, copper, and lead. As the exposed commercial ore was largely discovered and the known ore bodies were worked, it became necessary to employ new prospecting techniques, involving careful geologic mapping of rock formations and structural features that control or may control ore deposition. Through intensive study mining geologists and exploration engineers have learned the mechanics of replacement, structural control, contact metamorphism, zonal distribution, structural barriers, wallrock alteration, oxidation, and tectonics both before and after ore deposition. More recently emphasis has been given to a greater utilization of physics, chemistry, and mathematics, not only to obtain an understanding of how ore bodies came into being, but, more important, where they were localized. Utilizing geochemical and geophysical techniques largely developed in petroleum exploration, geologists and engineers have embarked on trace-element analyses of plants and top soil and on various physical measurements in areas judged favorable (*5*, *17*).

MINING

A variety of mining methods, which vary with the type of ore body, is used in extracting zinc ore. Underground methods employing either open or supported stopes yield most production, but open-pit methods have found limited application. Underground stoping methods in use include block caving, room-and-pillar with and without roof bolts, shrinkage stopes, cut-and-fill stopes, and timbered stopes. Zinc deposits amenable to open-pit methods are restricted to relatively few areas, and at the present the only mines of any size employing the method are the Van Stone in Washington (*14*, *24*) and the Barvue (*23*) in Quebec. A description of mining methods, their advantages and disadvantages, is given in Bureau of Mines Bulletin 419 (*16*).

Improvements in mining practice in the past 40 to 50 years have been based largely on the development and extensive use of power equipment. Thirty years ago almost all zinc ores were loaded by hand shoveling, whereas now almost all loading is done by power shovels, scrapers, or mucking machines. Transportation also has undergone great changes, as hand tramming and mulepower have been replaced by motortrains operating on heavy-gage track. More recently trackless mining, which utilizes electric- or diesel-powered units, is finding wide usage in the zinc and lead-zinc mines of Washington (*12*, *18*), the Tri-State district, the Upper Mississippi Valley (*1*), and Tennessee (*35*).

Other improvements in equipment that have done much to raise mine output per man-shift include better lighting at working places, better ventilation (including air conditioning), better and more efficient pumps, and harder hitting light rock drills using carbide bits.

It is believed the United States will continue to be a major zinc-ore- and metal-producing country as important ore bodies continue to be discovered and developed and more efficient operating techniques are devised. Major exploration, development, modernization, and expansion projects undertaken since January 1950 include mine and mill expansion at the Eagle mine, Gilman, Colo.; deep-level exploration at the Crescent and Hercules mines and elsewhere in the Coeur d'Alene region, Idaho; and introduction of block caving in the same area; development and plant construction, Indian Creek mine, Mo.; exploration and development work, Alice-Lexington mine, Butte, Mont.; mine development and plant construction, Sterling mine, Ogdensburg, N. J.; expansion of Balmat mine and mill, Balmat, N. Y.; exploration and development, Eureka Corp., Ltd. mine, Eureka, Nev.; development and construction at Friedensville mine, Friedens-

ville, Pa.; development of North Friends mine, Tenn.; development of Ivanhoe mine, Wythe County, Va.; development and construction, Van Stone mine, Wash.; mine and plant expansion, Pend Oreille mine, Wash.; and mine development and plant construction, Calumet and Hecla mine, Shullsburg, Wis.

MILLING

Milling (*30*), the physical process by which the zinc minerals are concentrated, consists of crushing and grinding to liberate the valuable mineral particles, followed by separation of the zinc mineral particles by gravity, flotation, or magnetic methods or some combination of them.

The particular combination of ore-dressing equipment used varies with the quantities and kinds of ore minerals present, their values, the character of the gangue minerals, and the mineral particle sizes. Simple ores, such as coarsely disseminated zinc or zinc-lead minerals occurring with a low specific gravity gangue, are readily treated in heavy-medium cones, jigs, and tables after being crushed and rolled in closed circuit with vibrating or trommel screens and classifiers to give properly sized feed. Collective or differential flotation of the slime products or of a reground middling product completes the flowsheet. Ores of this kind are common in the mines of the Mississippi Valley and eastern United States. In some instances the ores are concentrated wholly by flotation, but the Sussex County, N. J., zinc deposits are concentrated magnetically.

The more complex sulfide ores consist of disseminated mixtures of fine-grained lead and zinc sulfides, usually accompanied by pyrite, some copper sulfides, and some gold and silver in a quartz or quartz-calcite gangue. Such ores may be complicated further by partial oxidation of the sulfides and by high-specific-gravity gangue minerals, such as barite, siderite, rhodochrosite, or fluorite. The usual procedure on such an ore is to crush and grind in closed circuit with classifying equipment to a mesh at which the ore minerals are preponderantly separated from the gangue minerals. If the ore minerals are interlocked, it is usually good practice to make a bulk sulfide concentrate first rather than grind all gangue and ore minerals to a mesh at which selective flotation can take place; the bulk concentrate is then treated by regrinding and selective flotation.

The low capital and operating costs of the sink-float method promise to extend its field of use for pretreatment of certain ores to reject rock of noncommercial grade resulting from the cheaper, nonselective mining methods.

Zinc ores are concentrated and reduced with considerable loss of metal content. Present ore-dressing practice results in recoveries of about 80 to 92 percent of the sulfide zinc and from only a few percent to perhaps 85 percent of the oxidized zinc under very favorable circumstances. Recent Bureau of Mines investigations on improvement of zinc recoveries in ore dressing include hundreds of flotation tests to evaluate the efficiency of different reagent combinations on zinc and lead sulfide slimes and basic research into fine grinding and the physical chemistry of the resulting slimed minerals. In treating oxidized zinc and lead-zinc ores various degrees of success have been achieved with flotation and leaching methods. The very wide divergence in ore characteristics requires diversified techniques. Among the most successful in terms of metallurgical recovery are the leaching methods. One of these, termed the caustic leach-electrolytic process (*3*) is applicable to considerable tonnages of oxidized zinc-lead ores in Nevada, Utah, Arizona, and California that are not amenable to standard concentration processes and are uneconomic when shipped to standard smelters. By this process zinc is extracted from the ores with sodium hydroxide solution, after which the resulting electrolyte is purified with zinc dust and lime and the zinc electrodeposited. The caustic consumed in dissolving zinc is regenerated in electrolysis, while that consumed in dissolving carbonate and silicate gangue minerals is easily regenerated by causticizing with lime.

The process is also applicable to mixed sulfide ores of zinc and lead, which when roasted can be treated as satisfactorily as oxidized ores. Current research is based on precipitation of the zinc by chemical means. Leaching with sulfur dioxide under acidmaking conditions has also been very effective on certain complex oxidized lead-zinc ores from the southwestern United States.

Considerable attention in Italy and France has been given to the flotation of oxidized zinc ores with fatty amines (*27*), and 2 small mills in Italy and 1 in France are treating over 400 tons of oxidized zinc ores daily. The process has been tested at the Touissit and Zellidja mines of French Morocco since early 1953. If the method proves successful at the Toussit and Zellidja mines the output of Tunisia, Algeria, and Morocco may be expected to increase further as greater recovery will be made at existing plants and many oxidized zinc-lead ore bodies now deemed uneconomic will become profitable.

SMELTING (REDUCTION PLANTS)

Zinc smelting (*20*), in common usage, is the term applied to all treatment processes by

which zinc ores or concentrates are reduced to refined metal. Actually zinc is either recovered from its ores and concentrates by distillation in some one of several types of retorts or furnaces or by electrolysis.

Sulfide zinc concentrates are roasted to eliminate sulfur, and in the process the zinc is converted to the oxide and minor quantities of zinc sulfate. The roasted concentrate may either be leached to recover zinc solution for electrodeposition of the metal or combined with coke breeze, anthracite, or other solid fuel and retorted.

Distillation retort plants are classified as batch horizontal retorts, continuous vertical retorts fired by fuel, and continuous vertical retorts heated electrothermically. The zinc vapor and hot reducing carbon monoxide from the retorts pass into condensers of various types where the zinc is collected as liquid metal ready for casting into slab form. One large producer refines a portion of its production by further fractional distillation and rectification, but other distillation plants depend largely upon high-grade feed to retorts or liquation of the condensed zinc to secure the grades of slab zinc offered for sale. Several retort smelters produce zinc oxide and zinc dust as well as slab zinc.

The electrolytic zinc plants as noted above leach the roasted zinc concentrates to recover zinc solutions, which are purified to remove contained copper, cadmium, cobalt, iron, etc. The purified pregnant zinc solution is piped to the tankhouses, where the zinc is electrodeposited upon cathodes of high-grade aluminum. At intervals the cathodes are lifted from the tanks and stripped of the zinc coatings, which are then charged into a melting furnace to be melted for casting into slab form. The electrolysis of the solution regenerates sulfuric acid, which is used in another cycle of leaching.

The residues from distillation and leaching are shipped to a lead smelter for further processing when they contain economic quantities of lead, gold, or silver or processed in a Waelz kiln when economic quantities of zinc with or without lead remain.

The slags from lead blast furnaces often contain economic quantities of zinc and lead, which may be recovered as the oxides in slag-fuming plants. The lead slag from the Herculaneum (Mo.) smelter is electrothermically smelted for direct production of slab zinc. The oxides from both the Waelz kiln and slag-fuming plant are commonly deleaded and the resultant impure zinc oxide reduced to metal in an electrolytic or retort plant.

As shown in table 9 domestic smelters produce slab zinc in several grades, the degree of refining depending upon the type of producing plant and current demand. The electrolytic plants produce Special High-Grade or High-Grade slab zinc but may degrade their product to meet various market requirements. The slab zinc produced by the horizontal retort plants is largely Prime Western grade, although smaller quantities of all other grades are produced. The vertical retort plants preponderantly produce Regular High Grade, but all other grades are produced as demand warrants.

Metallurgical recoveries at zinc-reduction plants range from less than 85 percent in some instances to as high as 96 to 97.5 percent at others, the range in recovery being governed by the nature of the smelter feed, the treatment process, and the economics of recovery. The new Sterling process furnace (*13*) for electrothermic reduction of zinc ores is of much interest, because of its potentiality in treating high-iron-content zinc ores. The utilization of the blast furnace in reducing zinc ores at the Avonmouth plant of Imperial Smelting Corp. Ltd. also holds promise in treating complex zinc concentrates. Recent industry-modernization programs have included many improvements in roasting, among which are the use of Dwight-Lloyd sintering equipment to replace roasting hearths at the Blackwell (Okla.) smelter (*19*), introduction of a suspension roasting process at Trail, B. C. (*22*), and experimental use of the fluosolids roasting process at Amarillo, Tex.

The Bureau of Mines is doing research on secondary recovery in the electrorefining of zinc from anodes of zinc dross, an electrochemical process for recovery of zinc in sal skimmings, and the mechanical separation of zinc from dross and impure zinc condenser metal utilizing centrifugation.

RESERVES

Zinc-ore reserves (*8*) are widely distributed; important deposits occur in the United States, Canada, Mexico, Argentina, Bolivia, Peru, Chile, and Greenland in the Western Hemisphere and in many countries of Europe, Africa, and Asia, as well as in Australia. Zinc reserves in the measured and indicated classification are estimated to total over 70 million short tons of metal. Of this amount about 35 percent occurs in North America, 8 percent in South America, 30 percent in Europe, 15 percent in Australia, and about 8 percent in Africa and Asia. Partial information at hand suggests that the total zinc in measured, indicated, and inferred ore reserves approximates 200 to 300 million tons In addition there are doubtless very large quantities of metal in potential resources that are undiscovered or currently uneconomic.

TABLE 11.—*Estimated zinc reserves of the United States as of January 1950 (8)*

[Short tons of metallic zinc]

	Measured and indicated [1]		Inferred [2]		Total [2]	
	Gross content in ground	Recoverable content [3]	Gross content in ground	Recoverable content [3]	Gross content in ground	Recoverable content [3]
(1) Zinc in deposits that could be worked under technologic conditions similar to those in 1950	8, 480, 000	6, 530, 000	12, 700, 000	9, 800, 000	21, 200, 000	16, 300, 000
(2) Zinc in deposits workable under possible future technologic or industrial conditions	3, 440, 000	----------	400, 000	----------	3, 800, 000	----------

[1] This includes individual estimates of measured and indicated ore in some properties where such ore is known, but for which the tonnage figures are unavailable.

[2] Figures rounded.

[3] Milling and smelting losses are considered to be roughly 23 percent.

North America.—The United States, Canada, and Mexico have an estimated third of the world's developed reserves of zinc. The unwillingness of many mining firms precludes inclusion of a statement of reserves for the United States and Mexico on a current basis. An estimate of total zinc reserves in the United States as of January 1950 is given in table 11; it shows measured and indicated reserves of 8.48 million tons of zinc content. Developed reserves in Canada are estimated to contain 14 million tons of zinc. A recent discovery and partial development (1952–54) in Greenland suggests a considerable ore potential there.

Inferred ore in North America is believed to contain 65 to 100 million tons of additional zinc.

South America.—The combined reserves of developed ore in South America are estimated at 6 million tons of zinc or 8 percent of the world supply. Peru and Argentina have the largest reserves; those of Bolivia and Chile are somewhat smaller. Lack of development in such mineralized countries as Chile, Peru, Bolivia, Brazil, and Argentina suggests that very large reserves might well be developed.

Europe.—Europe produced about 800,000 short tons of newly-mined zinc in 1953 or roughly 28 percent of the world total. Measured and indicated reserves are estimated to contain 22 million tons of zinc, or about 30 percent of the world total. Of this quantity about 11 million tons is in eastern Europe and 11 million tons in western Europe.

Africa.—Africa has important zinc deposits in Algeria, Belgian Congo, French Morocco, Northern Rhodesia, South-West Africa, and Tunisia. Reserves contain about 4 million tons of zinc. The operation of the Société des Mines de Zellidja and Société Nord Africaine du Plomb at and near Oudjda, Morocco, extend into Algeria. Active exploration has shown large reserves capable of supporting a production of 120,000 tons of zinc concentrates (55 percent zinc) beginning in 1954. The Belgian Congo has important developed zinc reserves, a large part (450,000 to 600,000 tons of zinc) being in the copper slags at Lumbumbashi where the Prince Leopold ores are smelted. South-West Africa and Northern Rhodesia each have an important zinc-mining industry, with reserves that reportedly are large.

Asia.—Developed zinc reserves in Asia are estimated to be 4.5 million to 5 million tons, about half in Burma and the remainder divided among Japan, China, Korea, Viet Nam, and the Philippines.

Australia.—Australia has developed reserves containing about 11 million tons of zinc, or roughly 15 percent of the world total. The important deposits are at Broken Hill, and Captain's Flat, New South Wales; Mount Isa, Queensland; and the Read-Roseberry mine, Tasmania.

CONSUMPTION AND USES OF ZINC IN THE UNITED STATES

The consumption of slab zinc, of zinc in ore and concentrates for the direct manufacture of pigments and salts, and of zinc in scrap metal to make zinc alloys, zinc dust, chemicals, and pigments during the 29-year period 1925–53 averaged about 940,000 tons annually and in the last 5 years of that time period averaged 1,240,000 tons. An itemization of each element of annual supply and distribution for that 29-year period is given in table 12. The consumption of slab zinc, by industries and classes of product, is given in table 13.

The largest single use of zinc—galvanizing—employs about 40 percent of the total slab

TABLE 12.—*Salient statistics of the zinc industry in the United States, 1925–53* [1]

[All figures in thousand short tons]

Year	Supply				Distribution				
	Total	Recoverable mine production	Recoverable secondary	Imports [2]	Total	Slab zinc consumed	Consumed as ore in pigments, etc.	Exports [2]	Secondary [3]
1925	879	711	156	12	942	579	111	157	95
1926	956	775	168	13	996	622	130	140	104
1927	897	719	169	9	905	583	122	96	104
1928	878	695	181	2	898	626	124	38	110
1929	914	724	177	13	907	634	138	24	111
1930	746	595	128	23	646	451	105	11	79
1931	513	410	102	1	518	370	75	5	68
1932	362	285	75	2	380	259	55	11	55
1933	509	384	121	4	502	350	72	7	73
1934	550	439	97	14	515	360	76	13	66
1935	658	518	129	11	640	473	86	8	73
1936	749	576	161	12	778	582	96	7	93
1937	839	626	166	47	831	610	112	8	101
1938	659	517	119	23	574	421	69	8	76
1939	829	584	183	62	871	626	85	14	146
1940	1,057	665	222	170	1,075	719	96	90	170
1941	1,314	749	284	281	1,272	827	135	97	213
1942	1,452	768	331	353	1,250	728	115	140	267
1943	1,631	744	368	519	1,350	817	115	106	312
1944	1,493	719	345	429	1,346	889	142	26	289
1945	1,404	614	360	430	1,297	852	131	14	300
1946	1,215	575	301	339	1,242	801	134	62	245
1947	1,279	638	311	330	1,293	786	146	120	241
1948	1,283	630	325	328	1,280	818	133	77	252
1949	1,167	593	238	336	1,046	712	88	71	175
1950	1,345	623	326	396	1,375	967	134	25	249
1951	1,347	681	314	352	1,376	934	134	50	258
1952	1,478	666	310	502	1,278	853	109	66	250
1953	1,520	547	295	678	1,368	986	118	26	238
Average	1,032	613	223	196	991	663	110	52	166

[1] Sources: National Security Resources Board, Materials Survey—Zinc, 1951, and various Bureau of Mines data.

[2] Imports and exports are factored as follows: 100 percent of the metal is added to 85 percent of the zinc content of ores and concentrates.

[3] Consumed in dust, alloys, chemicals, and pigments.

zinc consumed. Galvanizing is recognized as the most economical means of protecting steel products from atmospheric corrosion. Zinc coating exposed to normal atmospheres forms an insoluble, adhering, impervious layer of zinc carbonate that resists further attack. The usefulness of this as a protective coating on steel is enhanced further by the fact that zinc is electropositive with respect to iron; hence, when a galvanized article is subjected to corrosion the zinc is sacrificed in favor of the iron. Zinc-coated steel products include roofing and siding sheets, wire and wire products for outdoor exposure, articles fabricated from sheet steel (such as range boilers, pails, cans, and tanks), hardware for outdoor use, pipe and conduit, and exposed structural steel.

In galvanizing the more widespread introduction of continuous hot-dip galvanizing (*10, 21*), with a new and superior zinc-alloy coating containing a small quantity of aluminum, is expected to cut costs of production and yield a better product having a considerable cost advantage over aluminum sheet and aluminum coatings.

The second largest class of slab-zinc usage is in die casting—the art of producing castings in quantity by forcing molten alloy into steel dies or molds. The equipment consists of a melting pot, an injecting device, and the die, with a device for opening and closing the die during operation. The zinc alloy is injected into the die at temperatures up to 900° F. and at pressures up to 2,500 pounds per square inch. Die casting requires a good structural metal that can be melted and used at relatively low temperatures, has little shrinkage, is dimensionally stable, and solidifies to a smooth finish without gas inclusions. Because of their excellent properties die-cast alloys are used for parts as small as zipper elements or as large as automobile radiator grilles. The automotive

TABLE 13.—*Consumption of slab zinc in the United States, 1944–48 (average) and 1949–53, by industries* [1]

[Short tons]

Industry and product	1944–48 (average)	1949	1950	1951	1952	1953
Galvanizing: [2]						
Sheet and strip	120, 818	146, 923	188, 406	144, 329	145, 875	164, 601
Wire and wire rope	46, 746	39, 231	47, 317	51, 792	48, 645	44, 100
Tubes and pipe	67, 041	78, 030	91, 877	79, 221	82, 043	88, 428
Fittings	11, 845	11, 487	15, 948	21, 186	10, 366	10, 330
Other	94, 595	75, 209	98, 138	103, 751	90, 759	99, 529
Total galvanizing	341, 045	350, 880	441, 686	400, 279	377, 688	406, 988
Brass products:						
Sheet, strip, and plate	112, 185	43, 157	68, 737	67, 815	71, 706	94, 826
Rod and wire	51, 677	23, 651	43, 413	46, 056	49, 831	47, 312
Tube	19, 957	12, 816	17, 385	15, 927	17, 057	18, 136
Castings and billets	8, 361	2, 620	4, 170	7, 098	7, 262	8, 145
Copper-base ingots	8, 458	2, 701	4, 081	5, 743	8, 223	7, 659
Other copper-base products	1, 741	589	1, 587	653	1, 529	2, 104
Total brass products	202, 379	85, 534	139, 373	143, 292	155, 608	178, 182
Zinc-base alloy:						
Die castings	169, 123	199, 665	285, 022	282, 812	225, 877	297, 280
Alloy dies and rod	5, 763	2, 024	2, 929	11, 135	9, 235	7, 140
Slush and sand castings	447	492	1, 576	2, 487	1, 577	3, 025
Total zinc-base alloy	175, 333	202, 181	289, 527	296, 434	236, 689	307, 445
Rolled zinc	82, 772	55, 200	68, 444	64, 085	51, 318	54, 649
Zinc oxide	18, 303	10, 292	18, 187	18, 223	17, 205	20, 675
Other uses:						
Wet batteries	1, 686	1, 359	1, 527	1, 749	1, 396	1, 417
Desilverizing lead	2, 254	2, 448	2, 947	2, 186	2, 370	2, 425
Light-metal alloys	1, 158	1, 060	1, 356	3, 132	3, 266	5, 939
Other [3]	4, 325	2, 887	4, 087	4, 591	7, 243	8, 207
Total other uses	9, 423	7, 754	9, 917	11, 658	14, 275	17, 988
Total consumption [4]	829, 255	711, 841	967, 134	933, 971	852, 783	985, 927

[1] Excludes some small consumers.
[2] Includes zinc used in electrogalvanizing and electroplating, but excludes sherardizing.
[3] Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.
[4] Includes 2,394 tons of remelt zinc in 1949, 3,035 tons in 1950, 4,505 tons in 1951, 4,144 tons in 1952, and 3,710 tons in 1953.

industry uses a great number of zinc die castings, including such items as carburetors, bodies for fuel pumps, parts for windshield wipers, speedometer frames, horns, heaters, parts for hydraulic brakes, door handles, instrument panels, and many others. Die castings are also used extensively in electrical appliances, business and other light machines, tools, building hardware, toys, and novelties.

In the consumption of zinc it is considered likely that die-casting uses will increase further, for although much is heard of the inroads of aluminum in this field zinc has inherent mechanical, physical, and chemical advantages over aluminum that make it the preferred metal for many die casting uses when zinc is selling at about two-thirds of the price of aluminum. American Die Casting Institute statistics on die-cast alloy shipments for various end uses indicate that there has been little substitution of aluminum but rather that zinc has maintained its position in most instances where the metals might be considered competitive. It is believed that the present strong supply position of zinc, the favorable price relationship, and the inherent advantages of the common zinc die-casting alloys will result in continued increases in demand.

Large quantities of slab zinc are consumed for brassmaking, especially in wartime. During World War II consumption of zinc for brass, principally for cartridge and shell cases and other military articles, composed nearly 50 percent of the total slab zinc consumed. Since 1946, however, zinc consumed for brass has averaged less than 15 percent of the total

slab zinc used. Zinc recovered from copper-base scrap (averaging about 175,000 tons annually) is consumed in making brass and bronze.

Developments in weapons and ammunition have lessened the probable requirements for brass in future wars, but civilian and military requirements remain large.

For use in sheet and rolled forms zinc is given the desired properties through alloying. Such uses include dry cells, jar caps, weather stripping, photoengraving plates, and roofing, as well as heavy plates for cathodic protection of steam boilers, ship hulls, and pipelines (*11*). Rolled zinc in building construction gives long service at reasonable cost and does not stain painted walls.

Zinc pigments and chemicals, most important of which are zinc oxide, leaded zinc oxide, lithopone, zinc chloride, and zinc sulfate, have literally hundreds of uses. Although the combined average annual shipments (zinc content) of these compounds is about 200,000 tons, only a small proportion (some 15,000 to 20,000 tons of zinc oxide) is produced from slab zinc, and the remainder of the compounds is produced directly from ore and secondary materials. The pigments and salts find many uses. The major uses for zinc oxide are in rubber, paints, ceramics, cosmetics and pharmaceuticals, textiles, and floor coverings. Leaded zinc oxide is used in paints. Lithopone is used in paints, varnish, lacquers, coated fabrics, textiles, floor coverings, rubber, paper filler, and printing ink. Zinc chloride goes into wood-preserving solutions, dry battery cells, refining oil, and soldering flux. Zinc sulfate is used in rayon, fertilizers, glue, textile dyes, electrogalvanizing solutions, insecticides, fungicides, chemicals, and soap.

About 25,000 tons of zinc in the form of dust is used annually as a reducing agent in the synthesis of dye intermediates, the manufacture of sodium and zinc hydrosulfite, sherardizing iron and steel products, metallic paints, and certain other uses.

SUBSTITUTES

There are few suitable substitutes for zinc in its major uses. For galvanizing iron and steel products there is no adequate substitute. Ceramic and plastic coatings are now employed in a narrow field that may gain in future importance. Cadmium is used for electroplating, but its cost and the quantity available limit it as an extensive substitute for zinc in galvanizing. Other metals, particularly aluminum, may be substituted for zinc coating on steel in some instances, but the cost to date has inhibited extensive use. Sheet aluminum is a strong competitor of galvanized steel, although it has poorer structural qualities and its cost is higher.

There is increasing consumption of wrought aluminum and magnesium, but the data available indicate that such consumption is largely in new uses and not at the expense of brass.

Aluminum competes with zinc in certain die-casting applications, and the competition between the two metals is influenced to some extent by metal price considerations. For the most part selection of an alloy depends upon the properties desired in the finished casting. In addition, where the use of electrodeposited coating is desired, zinc has a great advantage because of the ease with which finishes can be applied over die castings of zinc alloy.

Relatively few substitutes for zinc are available in chemical applications. Aluminum and magnesium could replace zinc to some extent as reducing agents in chemical reactions. In the paint industry lead and titanium pigments can be used instead of zinc pigments in many instances. Titanium pigments have replaced lithopone to a marked extent, but they supplement rather than compete with zinc oxide in paint in most formulations. Titanium dioxide has made inroads on the use of zinc oxide in porcelain enamels, but in opacifiers zirconium compounds have replaced zinc oxide only in part.

In general, there is little necessity to seek substitutes for zinc, as ample quantities of zinc in the various grades are available at relatively low prices in world markets.

FOREIGN TRADE

The foreign trade of the United States, as it relates to zinc, consists chiefly of imports of zinc concentrate and slab zinc and exportation of relatively small quantities of slab zinc.

IMPORTS

Imports were a neglible proportion of the total United States supply of zinc from 1925 to 1936 and consisted largely of ores and concentrates imported under bond for subsequent export. In 1937 imports increased markedly, initiating a period of greater dependence upon foreign supplies. Beginning in 1940 and continuing to the present, the greatly expanded demands for military and industrial purposes have been met in large part by greater volumes of imports. For the 14 years 1940–53 imports have averaged 418,000 tons a year or about 29 percent of the total supply.

Ores and concentrates consistently have been the principal category of imports, averaging about four-fifths of total zinc imports.

Canada and Mexico were the principal sources

of United States zinc imports throughout 1925–53 and during the last 14 years supplied about three-fourths of all imports. Mexico has been the chief source of ores and concentrates, supplying nearly half of the total; approximately 20 percent came from Canada. Canada supplied about 60 percent of the imported slab zinc and Mexico about one-third during the 29-year period.

In 1937 Peru began to export zinc ores and concentrates to the United States and, especially since 1941, has been a consistent source, averaging slightly less than 10 percent of total imports. During World War II considerable quantities of zinc in ores and concentrates came from Australia and Argentina. Chile, Belgian Congo, and Bolivia supplied smaller tonnages during the war years.

Table 14 shows imports of ores and concentrates (zinc content) and slab zinc by country of origin for 1937–53, and table 12 gives the total imports factored for smelter losses.

TABLE 14.—*Imports of zinc and zinc-bearing materials into the United States by countries of origin, 1937–53* [1] [2]

[Short tons]

Year	Zinc ores and concentrates (zinc content)							Blocks, pigs, slab and zinc scrap			
	Canada	Mexico	Argentina	Peru	Australia	Others	Total	Canada	Mexico	Others	Total
1937	84	338	--------	8,373	--------	17	8,812	6,695	8,375	24,058	39,128
1938	--------	7,253	--------	11,330	--------	--------	18,583	2,345	3,746	1,395	7,486
1939	1,613	23,221	1,544	9,722	--------	--------	36,100	6,908	16,554	7,961	31,423
1940	33,393	93,789	6,723	17,285	1,749	27,381	180,320	6,938	8,948	582	16,468
1941	49,764	148,201	20,579	28,833	8,933	32,903	289,213	7,236	25,621	1,697	34,554
1942	78,104	160,959	23,395	27,506	32,212	46,232	368,408	1,749	34,603	--------	36,352
1943	110,310	166,168	53,452	21,901	122,305	64,958	539,094	8,570	45,344	2,241	56,155
1944	112,299	177,625	22,253	34,889	42,216	24,414	413,696	18,099	39,703	5,824	63,626
1945	90,200	177,003	--------	35,415	15,377	63,724	381,719	46,594	36,105	14,417	97,116
1946	57,298	127,685	8,295	48,791	3,780	26,207	272,056	85,198	15,777	3,772	104,747
1947	42,230	163,726	--------	49,952	864	41,187	297,959	54,954	332	17,026	72,312
1948	55,371	142,134	77	22,475	495	43,651	264,203	77,660	5,737	9,835	93,232
1949	61,314	144,101	--------	14,901	4,956	15,907	241,179	109,708	14,191	3,026	126,925
1950	77,525	155,283	8	16,946	2,366	26,445	278,573	108,937	26,293	20,744	155,974
1951	96,568	143,769	5,546	29,136	2,825	24,749	302,593	85,066	760	2,217	88,043
1952	149,130	200,647	603	44,337	2,398	52,521	449,636	69,775	18,686	27,244	115,705
1953	165,737	168,937	--------	84,365	10,820	83,524	513,383	107,925	33,878	92,773	234,576

[1] All data compiled from records of the U. S. Department of Commerce.

[2] Data include zinc imported for immediate consumption plus material entering the country under bond.

EXPORTS

Zinc exports have reached substantial proportions only twice since 1925, once from 1925–1927 and again from 1940–49, except for 1944 and 1945. During the first period the annual average was 131,000 tons, composed about equally of ores and concentrates and slab and sheet zinc. In 1940–49 exports averaged 80,000 tons a year and were predominantly slab and sheet. The United Kingdom and India received the largest quantities of metal during this period. Exports totaled 66,000 and 26,000 tons, respectively, in 1952 and 1953. Exports of many manufactured materials contain an unmeasured but substantial amount of zinc.

TARIFF

Zinc has been subject to an import duty for over 100 years (*32*, *33*). The highest rates were in effect from 1930–39 when the duties on slab zinc and ores and concentrates (zinc content) were 1.75 and 1.50 cents per pound, respectively. In 1939 these tariffs were reduced to 1.40 and 1.20 cents per pound, respectively. In 1943 a reciprocal trade agreement between Mexico and the United States reduced the duty on slab zinc and zinc in ore to 50 percent of the amount set by the act of 1930, or 0.875 cent per pound on slab and 0.750 cent per pound on zinc in ore. This agreement was terminated December 31, 1950.

Following agreements at the Geneva Trade Conference of 1947 import duties were established, effective January 1948, as follows: 0.750 cent per pound for ore and concentrates (zinc content) and 0.875 cent per pound for blocks, pigs, or slabs. These rates applied equally to all nations with whom the United States has "Most-Favored Nation" agreements.

On June 6, 1951, import duties on slab and ore were reduced to 0.7 and 0.6 cent per pound, respectively. Owing to the increased United

TABLE 15.—*Zinc articles: United States rates of duty imposed under Tariff Act of 1930, in specified years 1930–54*

(United States Tariff Commission)

Item	Tariff rate in—				
	1930	1945	1948	1951	1954
	Cents per pound; percent ad valorem				
Par. 77:					
Zinc oxide and leaded zinc oxides containing not more than 25 per centum of lead:					
In any form of dry powder	1¾	1 1/10[1]	6/10[2]	6/10	6/10.
Ground in or mixed with oil or water.	2¼	1½[1]	1[2]	1	1.
Lithopone, and other combinations or mixtures of zinc sulfide and barium sulfate:					
Containing by weight less than 30 per centum of zinc sulfide.	1¾	1½[3]	⅞[2]	⅞	⅞.
Containing by weight 30 per centum or more of zinc sulfide.	1¾+15 percent.	1¾+15 percent.	⅞+7½ percent.[2]	⅞+7½ percent.	⅞+7½ percent.
	Cents per pound of zinc content				
Par. 393: Zinc-bearing ores of all kinds, except pyrites containing not more than 3 percent zinc.	1½	¾[1 4]	¾[2]	6/10[5]	6/10.[6]
	Cents per pound				
Par. 394:					
Zinc blocks, pigs, or slabs	1¾	⅞[1 4]	⅞[2]	7/10[5]	7/10.[6]
Old and worn-out zinc, fit only to be remanufactured, zinc dross, and zinc skimmings.	1½	¾[1 7]	¾[2 7]	¾[7]	¾.[7]
Zinc dust[8]	1¾	⅞[1 4]	⅞[2]	7/10[5]	7/10.
Zinc sheets	2	1[1]	1[2]	1	1.
Zinc sheets coated or plated with nickel or other metal (except gold, silver, or platinum), or solutions.	2¼	1⅛[1]	1⅛[2]	1⅛	1⅛.

[1] Trade agreement with Mexico, effective Jan. 30, 1943 through Dec. 31, 1950.
[2] General Agreement on Tariffs and Trade (GATT) (Geneva), effective Jan. 1, 1948.
[3] Trade agreement with the Netherlands, effective Feb. 1, 1936, through Dec. 31, 1947.
[4] Rate previously reduced in the trade agreement with Canada, effective Jan. 1, 1939, through Dec. 31, 1947, to 1⅓ cents per pound of zinc content on zinc-bearing ores, and to 1⅔ cents per pound on zinc blocks pigs, and slabs, and on zinc dust.
[5] GATT (Torquay), effective June 6, 1951.
[6] Duty suspended from Feb. 12, 1952, to July 23, 1952, inclusive (Public Law 258, 82d Congress).
[7] Duty on metal scrap suspended for practically the entire period from Mar. 14, 1942, to June 30, 1953, inclusive (Public Law 497, 77th Cong.; Public Laws 384 and 613, 80th Cong.; Public Law 869, 81st Cong.; and Public Laws 66 and 535, 82d Cong.).
[8] Since enactment of Public Law 497 (77th Cong.), effective Mar. 14, 1942 and subsequent amendments (see note 7 above), providing for temporary suspension of duties on metal scrap, quantities of zinc dust have been entered free of duty under this law. No information is available as to the distinction between the zinc dust which has entered free of duty and that which has entered as dutiable.

States need for foreign zinc, import duties were suspended on February 12, 1952, until March 31, 1953, or until the end of the emergency, whichever came first. The act stipulated that the rates of June 6, 1951, were to be reimposed if the average market price of zinc fell to 18 cents a pound for a calendar month. The Tariff Commission notified the President on July 3, 1952, that the average price of slab zinc for June was below 18 cents a pound, and on July 23 the President signed the order ending the duty suspension. In effect the general inflation in which the price of zinc has participated resulted in an additional lowering

of the tariff if considered on an ad valorem basis.

The high level of imports established in 1952–53, together with the depressed state of the domestic zinc- (and lead-) mining industry stimulated much study of various protective tariff proposals and other plans to aid the industry. A committee representing a large segment of the domestic lead- and zinc-mining industry petitioned the Tariff Commission for an investigation under the "escape-clause" provisions of the Trade Agreements Extension Act of 1951, which permits the President upon recommendation of the Tariff Commission, to increase duties by up to 50 percent of the rates prevailing on January 1, 1945. Congressional committees also adopted resolutions instructing the Tariff Commission to investigate imports of lead and zinc and their effects on domestic output. The report of this investigation (*32*) was factual and contained no recommendations. It showed that the existing tariff structure restricted imports but slightly and that during the past decade a substantial part of all zinc imports were exempted from duty.

The report on the "escape-clause" provisions of the Trade Agreements Extension Act of 1951 (*33*) recommended that import duties on most lead and zinc materials be increased 50 percent above the rates existing on January 1, 1945. The President did not accept the recommendations of the Tariff Commission (*36*), instead, he outlined an expanded stockpiling program for strengthening the lead and zinc industry as an integral part of the Nation's defense-mobilization base.

MARKETING AND PRICES

Slab zinc is sold on the standard specifications adopted by the American Society for Testing Materials and by industry generally, which provides for six standard grades.

Market prices of zinc are usually quoted in cents per pound, f. o. b. East St. Louis, although relatively little zinc is actually delivered at that point. Zinc is also quoted on a New York basis. The London price is the principal basis for foreign transactions. Sales agreements usually stipulate market price at time of sale or shipment, as published in some specified trade publications in the United States, usually the Engineering and Mining Journal. Special High-Grade and High-Grade zinc are sold on a delivered basis at a premium of 1.50 and 1.35 cents, respectively, above the price of Prime Western, East St. Louis. Intermediate, Brass Special and Select grades are sold at smaller premiums above the Prime Western price, f. o. b. East St. Louis.

The selling prices of zinc pigments and salts and zinc dust do not follow the minor fluctuations in the price of slab zinc but are affected by the major price movements. In the raw-materials group (including zinc concentrates and byproducts) negotiations by individual contracts and spot sales are the practice, except for concentrates in the Joplin, Mo., area, where a market price for concentrates produced from ores mined in the district is published weekly.

Zinc prices have fluctuated widely during 1925–53. The average price for Prime Western grade, East St. Louis, was 6.76 cents per pound in 1925–29 and 5.10 cents in 1935–39, with an intervening low of 2.88 cents in 1932. The upswing in prices created by the demands of World War II was halted in October 1941 by the Government, which set the controlled price at 7.25 cents per pound. In October 1942 the price was established at 8.25 cents per pound, at which level it remained until controls were removed in the fall of 1946. Prices increased substantially in the postwar period, reaching a high of 17.50 cents in December 1948 and averaging 12.53 cents for 1947–50.

Following the outbreak of war in Korea in June 1950 zinc prices advanced steadily, attaining a peak of 17.50 cents in September. Ceiling prices were established for zinc on January 26, 1951, at the highest price (for each seller) at which sales were made between December 19, 1950, and January 25, 1951. Thus a number of different ceiling prices were maintained. The bulk of zinc sales, however, were at 17.50 cents per pound, Prime Western grade, East St. Louis. This price remained in effect until October 2, 1951, when the Office of Price Stabilization permitted a rise of 2 cents per pound. Increased supplies and lower consumption brought about marked reductions in zinc prices in the summer of 1952. On June 2 the price dropped to 17.50 cents and by August 6 was down to 13.50 cents. The price advanced slightly thereafter but as of October 21 was again down to 13.50 cents. Subsequently on October 23 it declined to 12.50 cents, at which point it remained throughout the remainder of 1952. Excess supplies brought about further reductions in price in 1953; the market opened at 13.00 cents a pound for Prime Western f. o. b. E. St. Louis but thereafter declined until September 11, when the price was 10.00 cents a pound. This price remained in effect to the end of the year. Thus in the 16-month period from June 2, 1952, to September 11, 1953, the price of zinc dropped from 19.5 to 10 cents a pound, the greatest drop in so short a period since 1916. Prime Western grade zinc dropped further in 1954, reaching a low of 9.25 cents on February 15, but thereafter the price increased

without interruption to 11.50 cents on September 7, at which it remained for the rest of 1954.

SELF-SUFFICIENCY AND STRATEGIC CONSIDERATIONS IN THE UNITED STATES

The United States is not self-sufficient in zinc. Over the past 29 years about 59 percent of the Nation's supply has been met from domestic mine production, 22 percent from secondary recovery, and 19 percent by imports, but in the 4 years ended in 1953 mine production has been only 44 percent of the total supply, imports 34 percent, and secondary 22 percent.

The differences in supply and distribution figures given in table 12 (p. 18), however, show that supplies and hence imports were considerably over requirements during the World War II period and again in 1952–53 and thus caused the accumulation of large stocks. If stock accumulations and exports are discounted it may be seen that United States import requirements averaged about 238,000 tons annually to meet industrial needs in 1940–53. Acually imports (metal equivalent) averaged 388,000 tons a year during the past 14 years or 150,000 tons a year over consumption.

In 1952–53, imports of recoverable metal totaled 1,180,000 tons or 444,000 tons over the quantity needed to balance supply and requirements exclusive of exports (see table 12, p. 18). Moreover, imports of such record tonnages exerted a depressing effect on domestic mine production, so that this component of supply furnished a considerably smaller proportion of the total than in previous years. In retrospect, it would seem that for 1952–53 imports of about 230,000 tons a year would have been ample to fulfill domestic needs which could not have been supplied from domestic sources.

Thus, while the United States is not self-sufficient in zinc, it does not depend strategically on foreign sources to anywhere near the extent suggested by imports in recent years.

GOVERNMENT PROGRAMS

The Government regulated the zinc industry during World War II and again in 1950–52 to assure adequate supplies for all essential purposes. In World War II measures were taken to increase imports, particularly of ore and concentrates, to expand or at least maintain domestic mine production, expand smelter capacity, establish a stockpile, and control consumption and exports.

The first measures taken included the expansion of imports, partly by purchase agreements (for example, with the Government of Mexico) and partly by agreement with other Allies to divert to the United States exports from Canada and Australia, which normally went to Great Britain and Belgium. This program was a notable success. Imports of ore, which shortly before the war averaged about 9,000 tons a year, had by 1943 reached a high of 539,000 tons, and the annual average for the entire wartime period was over 400,000 tons.

Imports of metal, which in prewar years totaled about 19,000 tons, added an average of about 70,000 tons of metal annually to the total supply during the war years.

Various measures were adopted to increase or at least maintain domestic mine production. The most important of these was the Premium Price Plan, designed primarily to increase production from submarginal ores by paying premiums for production above a certain quota based on 1941 production. Through payment of these premiums, marginal and lower-grade ores were mined, and tailing piles previously considered worthless were reworked. In addition, new and idle mines were brought into production, and more extensive development work was initiated in some existing mines. Despite increasing costs and labor difficulties, mine production in the war years 1942–44 averaged 744,000 tons—about 25 percent above the 1936–38 average.

During the 5½ years the plan was in operation (February 1942–June 1947) 56 percent of all the zinc produced received premiums. In all, a premium of about 177 million dollars was paid for the 2,090,000 tons of premium-produced zinc. The weighted average price paid for all zinc during the period was 10.92 cents a pound, of which premium payments came to 2.36 cents a pound.

The plan for the Government to purchase zinc developed into a stockpiling program dating from the spring of 1941, when the Metals Reserve Company was authorized to purchase up to 100,000 short tons of zinc concentrates from Argentina and Australia. The requirements were increased 150,000 tons in June 1941. In May 1942 the Metals Reserve Company was authorized to purchase up to 600,000 tons of foreign zinc concentrates annually. Total stocks at the end of 1942 totaled 464,000 tons and a year later had reached 617,000 tons.

Early in 1944 further consideration was given to stockpile objectives. An overall total of 800,000 tons was approved, comprising both Government and industry-owned stocks of slab zinc and recoverable zinc in concentrates. By the end of the year the total objective had been exceeded, with total stocks at 810,000 tons. Government stocks approximated the goal of 550,000 tons. From the beginning of

1945 to the end of the war stocks were gradually reduced.

At the end of the war, with a heavy demand from industry for reconversion needs, Government stocks were made available to consumers unable to obtain normal requirements in the market, except for quantities transferred to the United States Department of the Treasury, Bureau of Federal Supply, under the Stockpiling Act of 1946. Thus the wartime stockpiling program of the Government, which was generally effective in meeting wartime needs, carried over in part into a peacetime stockpile.

Soon after the onset of the war in Europe it became evident that the demand for zinc by the United Kingdom and its Allies would exceed the resources of the United States. At first voluntary allocations by industry of available supplies of zinc were tried. Owing to the growing pressure of defense orders these voluntary measures soon became inadequate.

Control of exports had already been initiated by the Government early in 1941. In June of that year the Office of Production Management placed zinc under full priority control, with issuance of General Preference Order M–11. This order, with subsequent modifications and additions, controlled the allocation of zinc, including dust and scrap, for essential military and civilian uses, prohibited its use for certain purposes, established inventory controls, and provided for detailed reports to be filed by producers and users of zinc. It was administered after January 1942 by the War Production Board, successor to OPM.

Through these control measures enough zinc was provided to meet the most urgent military and civilian requirements during the war years. Controls were continued until the end of the war, although they were relaxed somewhat in September 1944, when supply appeared adequate. Full controls were reinstated in April 1945, mainly because of a shortage of the higher grades of zinc, and were continued until August 20, a few days after the end of the war with Japan.

The Korean War in 1950 and the prompt acceleration of the United States defense program were reflected in the introduction of Government controls over the zinc industry in the latter part of the year.

National Production Authority Order M–15 issued December 1, 1950, limited civilian consumers of zinc and zinc-metal products to an average quarterly consumption rate not to exceed 80 percent of their quarterly average, as established in the 6-month period ended June 30, 1950. The same order specified that inventories should not exceed a 45-day supply or a "practicable minimum working inventory," whichever was less. On June 15, 1951, Order M–15 was amended to limit quarterly consumption of Special High-Grade zinc to 70 percent of that used in the basing period, and allowable inventories of zinc and zinc-metal products were restricted to 30 days or the "practicable minimum working inventory," whichever was less.

On July 5 NPA issued a new order, M–9, which placed slab zinc under allocation effective August 1. Under this order no dealer or consumer might accept delivery of 20 short tons or more of slab zinc during any calendar month without an allocation authorization. Amendment 1 to this order, effective January 1, 1952, reduced allowable receipts without allocation authorization from 20 to 10 short tons in any calendar month. Several provisions of Order M–15 were incorporated in Order M–9 as amended March 7, 1952. All NPA restrictions on zinc were revoked on June 27, when it was apparent that zinc was not in short supply.

BUREAU OF MINES EXPLORATION PROGRAM

Under authorization of the Congress, the Bureau of Mines during World War II undertook a strategic minerals development program that included zinc. Over 2,200 zinc and zinc-lead properties were examined, and 20 million tons of ore in all were indicated at about 85 of the 140 deposits drilled or otherwise explored. Outstanding accomplishments of the program with respect to zinc were the ore discoveries in the Metaline district of northeastern Washington and near Galena, Ill. Subsequent private exploration greatly increased the zinc reserves as well as the zinc-ore output of the two areas.

GOVERNMENT EXPLORATION AND EXPANSION PROGRAMS UNDER THE DEFENSE ACT OF 1950

On December 4, 1950, the Defense Minerals Administration was established by the Secretary of the Interior under the provisions of the Defense Production Act of 1950. The function of DMA was to increase the supply of necessary minerals through exploration and expansion programs. In mid-1951 the exploration function was transferred to the Defense Minerals Exploration Administration, and soon thereafter the production expansion and procurement function was transferred to the Defense Materials Procurement Agency under the General Services Administration. DMA–DMEA by the close of 1953 had approved and entered into 175 mineral-exploration contracts for zinc and lead, obligating the Government for up to 50 percent of the cost, or a total of $7,297,000. In conformance with an order by the Office of Defense Mobilization no loans

could be made on zinc and lead applications received after May 15, 1953. This order was amended, however, March 23, 1954, to again permit loans on approved exploration projects.

DMPA, in fulfilling its responsibility for production expansion, made purchase contracts (including subsidies where warranted), granted priority ratings for production machinery and equipment, and recommended production expansion loans, operating loans, and certificates of necessity for accelerated tax amortization. The expansion program was not confined to domestic producers, and a number of foreign contracts were negotiated to bring in additional supplies of zinc. In early 1953 the DMPA program was greatly reduced, and on August 14 of that year the remaining functions of DMPA —including completion of contracts in negotiation and the servicing of existing contracts— were transferred to the Emergency Procurement Service of General Services Administration. In total, purchase commitments at guaranteed prices were made with 9 domestic and 3 foreign producers for 124,526 tons of zinc; loans totaling $1,820,000 were certified for 9 domestic producers and 1 foreign producer, and 41 certificates of necessity were granted for accelerated tax amortization in plant expansions expected to result in 182,000 tons of additional zinc capacity per year.

OUTLOOK

World reserves of measured, indicated, and inferred zinc ores appear adequate to meet the foreseeable requirements of the next 40 years, and the potential of new discoveries in known mining districts and undeveloped areas of the world is believed to be much larger. World consumption will increase, requiring an annual mine output of about 3,000,000 tons of zinc by 1965 compared to about 2,500,000 tons at present.

United States reserves will permit continuation of present or somewhat greater domestic mine output for many years. It seems probable, however, that a larger part of the supply will be met by imports, for not only will requirements increase greatly, but the ratio of scrap generation to total consumption is declining. Government purchases of newly mined domestic zinc should stimulate domestic mine production to about 500,000 tons of recoverable metal in 1955. In the ensuing decade mine production can be expected to average 550,000 to 600,000 tons a year. Total distribution, which includes slab-zinc consumption, direct consumption of ore in pigments and chemicals, consumption of secondary metal and exports totaled about 1,370,000 tons in 1953. Projecting requirements and assuming a high level of industrial activity, total zinc requirements are expected to approximate 1,450,000 tons by 1960 and 1,650,000 tons by 1975.

PROBLEMS

To produce zinc at a competitive price, industry undertakes numerous research problems involving ore finding and improved mining, milling, and smelting practice, as well as market research and development. Government also conducts numerous research projects in exploration, ore dressing, and extractive and process metallurgy, as well as in mineral market surveys.

The easily discovered deposits have been or are being exploited. New ore discoveries will require intensive scientific search, utilizing advance prospecting and exploration techniques involving improved geological techniques and exploration tools. Research to lower the unit cost of exploratory openings and to improve the accuracy of sampling is particularly needed.

Research problems in mining that need particular study include lower cost ore breakage, ground support, and ore transport. An element in the solution of this and all other industry problems is widespread publication of acceptable solutions, so that good practice will become widespread. There is constant need for research to improve fine crushing and grinding, frequently the highest cost items in the ore-dressing process. Research should be particularly focused on the recovery of slime sulfides and the overall recovery of the complex and difficult-to-recover oxide minerals.

At present zinc ores are reduced to metal by five commercial processes that vary widely in metallurgical efficiency, labor, and capital requirements. Although much research has been done in developing and improving them, much remains to be done to improve metal extraction and unit cost.

Market research offers a large area in developing better alloys and improved or new applications for them. The ample supply and low cost of zinc justify much research on products and markets by both producers and consumers.

The zinc industry needs better information on which to base industry decisions. The solution of industry problems often requires tabulation of adequate up-to-the-minute statistics to permit more accurate predictions, so that productive capacity and stocks can be maintained at optimum levels.

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MINING DEPARTMENT

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F. V. R.

MAY 24 1954

MEMORANDUM:

OXIDIZED ZINC ORE

Approximately three years ago, Stanford Research Institute conducted a study of available sources of oxidized zinc ore, in the western states, for a small company known as Manilla Development Co. of Chicago, Illinois.

It had been planned to treat these ores by an alkaline leach process. Drop in the price of zinc is given as one of the reasons why the study was dropped without going into operation. Another reason is said to be advice given by a consulting firm in New York City to the effect that the proposed program could not hope to compete with large competitors already established in the zinc industry, naming one of these in particular as the New Jersey Zinc Company.

Mr. Arthur Wilder, metallurgist for Stanford Research Institute, and my informant in the matter, could not recall the name of the partnership responsible for this advice but he stated they were in some way connected with the New Jersey Zinc Company. Mr. William Beatty, mining engineer for SRI, compiled the source-supply data.

Ed: no interest on our part, in this! WRL

If treatment of oxidized zinc ores should be of interest to the Smelting Company, arrangements probably could be made to data that is already in the Institute's files. The Institute operates on a fee basis for non-members.

Original Signed By
L. KENNETH WILSON

L. Kenneth Wilson

LKW:mb

cc:FVRichard
WRLandwehr

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ZINC - A EUROPEAN SURVEY

By R. Lewis Stubbs
Director
Zinc Development Association
Oxford, England

Western Europe at present consists of eighteen countries with a total population of 300 million and a land area of some 150 million square miles; compared with the U.S., there are twice as many people living in half the area. Nine of these countries have zinc smelters and ten or more mine zinc, although some of them do so on rather a small scale. In Europe the national frontiers, from which you are happily free, still hamper the movement of metals and so the zinc industry in each country tends to be individual in character.

Until the beginning of the last war, the U.S. and the European industries were distinct. The U.S. was neither an importer nor an exporter, and her industry was adequately protected by tariff barriers. So Europe was, until the war, the centre for international zinc trade and, taken as a whole, the largest producer and consumer of zinc in the world. Since the U.S. and European industries may be said to have developed separately, it seems better to begin by briefly reviewing the main events in the history of the European industry. The whole pattern of present day production and consumption has been shaped by events which are now often forgotten.

I. DEVELOPMENT OF THE EUROPEAN INDUSTRY

The first European zinc was made at Bristol in England in 1740, but production was not significant until horizontal retorts were invented in Silesia in 1798. The Belgians made improvements to the horizontal retort

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American Zinc Institute, Inc., St. Louis
Missouri, April 27, 1953)

process in 1807 and it has not altered much since. By 1900 many countries had founded smelters based on local or nearby mines - Russia in 1816, England in 1835, France in 1855, Spain in 1866, Holland in 1893 and Italy in 1897. The Belgian and some of the other mines were nearly exhausted by the end of the century, but the Silesian ore body, on which the German industry was founded and which was the richest in Europe, is still an important source of zinc, although it is now behind the Iron Curtain.

At the outbreak of the first world war two-thirds of the world's production was in Europe. The rest was in the U.S. which was self-contained and by 1909 had become the largest single producer. Germany was then the biggest producer in Europe, and with Belgium accounted for three-quarters of the European output. By that time smelter production had outstripped the mine production on which it had been based, and about a third of the European metal was derived from imported ores.

The war dislocated production in Europe and it was not until the early twenties that it regained its previous level; by 1921 Belgium had become the biggest European producer. About this time selective flotation was developed to treat complex sulphide ores, of which large quantities were available, and the concentrate produced was particularly suitable for electrolytic refining. This invention had serious repercussions in Europe since it led to the growth of important refining industries in Canada, Mexico, Australia, Indo-China and Japan and later in Rhodesia. The steady expansion of the European industry was checked and between 1920 and 1930 the London price fell from about £62 per ton (11cts/lb.) to £13.5 (about 2½ cts) as world supplies became more plentiful.

After the end of the depression and with the beginning of rearmament, consumption began to rise again but between 1930 and 1938 the price declined further to about £12 per ton.

The whole period between the wars was one of great uncertainty for the European industry. It had begun with an ore shortage, but most of the time was marked by an over-supply of both metal and ores. While consumption increased nearly 70% in the United States, it rose less than 20% in Europe and by a relatively small tonnage elsewhere; world smelter production increased about 58%, mainly in countries such as Canada, Australia and Mexico where consumption was low. Although Europe in 1938 still produced about two-thirds of the zinc made outside the United States, the growth of overseas smelters had weakened the position of those in Europe, which were dependent on imported ores for almost half their production.

The second world war has resulted in political and economic changes which have seriously affected the European industry. Important smelter capacity has been lost to Russia, which now controls the Polish, Czech and some of the German smelters, which together produced about 180,000 tons of zinc in 1938.

The large Silesian ore bodies, with an annual production of about 200,000 tons of zinc in concentrates, have also passed into Russian hands. These losses have been to some extent made good by recent developments in French overseas territories in Africa, which are expected to produce 60,000 tons this year, while in the Belgian Congo the annual ore production is now thought to be about 90,000 tons of zinc in concentrates. Moreover, in the U.S. consumption has now outstripped production and she has become an even larger net importer than Europe of both concentrates and metal. So Europe for the time being at any rate seems to have lost her position as the centre of the zinc world.

The table shows how Western Europe's relative importance as a zinc producer has declined since the war. World production has grown, but European production, after rising between the wars, is now lower than in 1913 owing of course to the loss of the Silesian industry to Russia.

TABLE 1 - ZINC PRODUCTION 1913-1950

1000's metric tons

	1913	1938	1950
Europe	682	756	595*
U.S.A.	320	540	826
World Total	1015	1582	1819

* Western Europe only

II. POST-WAR DEVELOPMENTS

Most European smelters kept going during the war and none within the present boundaries of Western Europe were destroyed, although some were damaged. However, financial and other difficulties prevented them from resuming full production immediately after the war and they were faced with the problem of getting adequate supplies of concentrates, which were not moving freely owing to the world shortage of transport. They also found that some of their former suppliers in Mexico, South America and Canada had acquired new markets in the U.S. which had previously not been interested in foreign concentrates. So it was not until 1950 that many European mines and smelters reached their pre-war output, especially those in Germany and Italy. However in 1951 and 1952 smelter production was higher than ever before, when allowance is made for the loss of the Russian-controlled Polish and German production. Mine production was also at record levels, and if the Belgian Congo and French African mines are added, it was almost up to the 1938 figure, which included the Silesian mines. As a result of this growth of mine production in Africa, which for practical purposes can be included in the European figures, and with the rise in the amount of scrap which passes through the smelters, it would seem that Europe's dependence on imports of concentrates from the American continent and Australia is diminishing; perhaps it would be rash to assume that this trend will continue. Only Spain has recently shipped concentrates out of Europe.

The following table summarizes European zinc supplies. The 1952

figures are partly estimated and I shall be referring later to the estimates for 1953. The 1913 and 1938 figures include Poland whose output was consumed in Western Europe before the war.

TABLE 2 - SUMMARY OF EUROPEAN ZINC SUPPLIES*

1000's of metric tons

	1913	1938	1947	1948	1949	1950	1951	1952	Estimated 1953
Mine production inc. Belgian and French overseas territories	471	543	253	280	327	429	481	483	526
Scrap for refining	-	15	25	35	45	50	60	60	60
Net imports of concentrates	211	198	79	115	138	116	109	92	65
Smelter production	682	756	357	430	510	595	650	635	651
Consumption	672	797	521	577	616	706	713	617	659
Net imports of metal	-10	41	164	167	106	111	63	-18	8

*Figures for individual countries are given in the appendices. The amount of scrap shown has been partly estimated. The net imports of concentrates make no provision for those used in the manufacture of zinc oxide and lithopone, which account for only a very small tonnage in Europe.

While total European smelter production has grown from about 360,000 tons in 1947 to 635,000 tons in 1952, total consumption followed a rather different course and was already at the rate of 520,000 tons in 1947, rising to 710,000 tons in 1951. In other words the smelters were slower in achieving their pre-war rates of production than were the fabricators; and outside Germany and Italy, consumption nearly everywhere was already at its present rate by 1947. Europe's dependence on net imports of metal is now back to the 1938 level, and indeed in 1952, when consumption was low, Europe appears to have had a small exportable surplus. In practice Europe is of course an exporter as well as an importer and in recent years Belgium, Germany, Italy and Norway have all sold metal to the U. S.

Since the war the European industry's problems have been complicated by the absence of a recognized world price, and by the growth of government control and regulations designed to conserve foreign currency and to encourage home production. At present only Denmark, Norway, Sweden, Germany and Greece

appear to have no restrictions or duties on the import of zinc or zinc concentrates. The world shortage affected price more severely in Europe than anywhere else, as the various quotations for zinc throughout the world all applied to some European supplies. We had the U.S. quotation East St. Louis and the closely related British Government price, on which were based the controlled prices of home production in several countries. Non-controlled prices included those for dollar transactions, f.a.s. Gulf Ports, which rose to about 32 cts, and for soft currency transactions which reached 38 cts/lb. It is easy to imagine the difficulties these differences caused among European producers and consumers.

However, in Europe only Britain and some smaller countries seem to have been acutely short of zinc in 1950 and 1951, and recent statistics show that in many countries consumption reached record levels in these years. There is no doubt that in Europe the distribution of zinc was distorted both by the lack of a recognized international price and by Government controls; consumers in some European countries had more metal than they could use while others went short. The International Materials Conference had some success in easing local shortages by asking countries to limit their zinc consumption during 1951. But the high prices also played their part since they encouraged new production and led consumers to seek substitutes.

The British Government, which had been the sole buyer and seller of zinc in Britain since 1939, returned the trade to private business at the end of 1952 and the London Metal Exchange, the traditional European futures market for zinc, which determined European price levels, reopened for dealings on January 2nd, 1953. It is already having an important influence on world prices and may perhaps soon provide the international price as well as the hedging facilities which are essential for satisfactory European trade in concentrates and metals.

III. FEATURES OF EUROPEAN PRODUCTION

So far, we have been dealing with Europe as a whold, but the time has now come to look at individual countries, since in practice the mining and smelting industries are distributed over the map in a rather remarkable way. The fact is that both geography and history have imposed a pattern of development which it is often hard to understand nowadays. But for the present at least, we Europeans have to make the best of it.

Much of the European smelting industry is located in or near the Ruhr and lower Rhine area, either in Belgium, Germany, France or Holland, where there are abundant supplies of coal and labour. The European mines, however, are widely dispersed. A list of the names of the European zinc producers is given in Appendix 4.

Many smelters were built to treat concentrates from local mines (zinc is still mined in the Rhineland)but most have now become custom smelters, as is strikingly shown in the case of Belgium. Its smelters were founded on local mines which passed their peak a hundred years ago and are now exhausted. But the Belgian smelting industry, which produced 200,000 tons in 1951, is still the largest in Europe, although now entirely dependent on imported concentrates; its output is only exceeded by that of the U.S. The Vieille Montagne Company, the leading Belgian producer, also operates smelters in France and Germany and owned mines in Sweden, France and North Africa; with other Belgian producers it shares in the control of the new 40,000 ton electrolytic refinery in the Belgian Congo which will be completed this year. The important French producer, Compagnie Royale Asturienne des Mines, which operates smelters in Spain and Norway as well as in France, is also Belgian-owned, as is the Dutch Campine smelter which is just outside the Belgian frontier and is to all intents a Belgian plant. Altogether some 60% of European smelter capacity is Belgian owned, although

since the war her hold has been less effective than it was since many Governments now exercise a close control over mines and smelters in their own countries.

The only British smelter, the Imperial Smelting Corporation, is now a wholly owned subsidiary of the recently formed Consolidated Zinc Corporation, an Anglo-Australian company with mines at Broken Hill in Australia. The British industry, which produces about 75,000 tons a year mainly from Australian concentrates, is the only one in Europe with important connections in the New World. Britain, whose home production meets only about a third of her requirements, imports the remainder mainly from Canada and Australia, rather than from Europe, though some metal is also imported from Belgium and Norway. In 1932, Britain imposed a 10% duty on non-Empire zinc which, for ease of collection, was later assessed at 30s. a ton, the equivalent of 10% of the London Metal Exchange price in 1939.

The German industry, although it has lost to Russia about a third of its smelter capacity and most of its pre-war mine output, is still the second largest in Europe and produced 156,000 tons of zinc in 1951. The main deposits remaining in Germany are those in the Harz mountains; they are smelted nearby at Oker in a vertical retort plant with a capacity of 35,000 tons. Other mines and smelters are mostly in the Rhineland. The properties now in Russian territory were separately owned and so their loss has not altered the structure of the remaining industry, although of course it is now partly dependent on imported concentrates.

In France the main smelters are the Belgian-owned Vieille Montagne and Compagnie Royale Asturienne des Mines. Together they made 70,000 of the 80,000 tons of metal produced in 1952; the remaining 10,000 tons came from the Penarroya Company which is better known as a lead producer. It also ownes mines in Spain and the important Pertusola smelter and mines in Italy. C.R.A.M. is now adding to its French properties a 20,000 ton vertical retort unit which

should start working within a few months. Last year some 12,000 tons of zinc in ore was mined in France. In the French African territories mine output is expanding and the recently developed Zellidja mine should swell the total this year to about 64,000 tons - a rise of some 30,000 tons. However, since both the St. Joseph Lead Co. and the Newmont Mining Co. have interests in North Africa, some of these concentrates may go to the U. S.

In Italy, too, production is growing and the new electrolytic refinery at Nossa near Bergamo, which will eventually have a capacity of 16,000 tons, was started up last year. It has been designed to treat the low grade oxidized ores found nearby. The Italian industry differs from most in Europe in having been entirely built since the first world war. It consists of four electrolytic refineries and one horizontal retort smelter. Most of Italy's mine output, which reached 100,000 tons in 1951 and 1952, comes from Sardinia.

Two other new electrolytic refineries should be operating in Europe by 1954. The largest will be the 20,000 ton plant at Sabac in Yugoslavia. The other will be in Austria where a refinery with a capacity of 10,000 tons is being built to treat the concentrates from the Bleiberg mines and also possibly from nearby mines in Italy.

The European industry differs from industries elsewhere in several important respects. For example, most production is still from horizontal retorts which accounted for very nearly two-thirds of the 1952 total of 635,000 tons; 22% came from the more modern electrolytic refineries and 14% from vertical retorts. Only Italy, Spain and Yugoslavia have enough ore and metal production to meet home consumption, although France also seems to be approaching self-sufficiency. More striking perhaps is the fact that Belgium, still the largest metal producer

outside the U.S., is entirely dependent on imports of concentrates. Britain, the largest consumer outside the U.S., is dependent on imports of both concentrates and metal. The only European countries with a net export surplus of metal are Belgium, Norway, Yugoslavia, Italy and Holland.

IV. CONSUMPTION

The time has now come to consider consumption, perhaps the most important factor in the prosperity of the industry. Between 1913 and 1938 consumption in Europe rose only by about 20%, while the consumption of iron and steel, which we might take as a general guide to industrial activity, increased by about 50%. Perhaps the reason was that the use of rolled zinc, which took over 50% of European production in 1913, declined between the wars and this offset the gains in galvanizing and other uses.

After the war several countries, notably Britain, France, Sweden and Switzerland, quickly resumed their pre-war rate, but in most others recovery was slower. However, the total European consumption for 1950 and 1951 has been higher than pre-war when account is taken of the loss of fabricating capacity in Eastern Germany, Poland and Czechoslovakia. So it is safe to assume that the trend in post-war consumption for Europe, which rose steadily from 1947 to 1951, has reflected not only the re-building of Europe but also a rise in the demand for zinc. Consumption fell in 1952, a fact which will be referred to later on.

The rate of consumption per head of population varies enormously from country to country with Belgium highest at about 16 lb. per head in 1950. Britain is next with 11 lb., followed by Norway, Germany, Sweden, France, Switzerland and Holland. Agricultural countries such as Greece and Portugal are lowest at less than ½ lb. For comparison the U.S. uses about 14 lb. per head.

<u>The Pattern of Consumption.</u> The following table shows the pattern of consumption of virgin zinc in Europe and the U.S.

TABLE 6 - PATTERN OF VIRGIN ZINC CONSUMPTION IN 1950

	Galvanizing	Rolled Zinc	Die Casting	Brass	ZnO	Misc.
Total Western Europe inc. U.K.	34%	27%	9%	15%	7%	8%
Western Europe without U.K.	32%	35%	6%	11%	5%	11%
U.K.	40%	12%	14%	21%	12%	1%
U.S.A. (1950)	45%	7%	30%	15%	3%	

Although European statistics of consumption are now better than before the war, only the British figures give a breakdown into uses comparable with those of the U.S. Britain alone collects figures of actual consumption which take account of stock variations; all other figures show apparent consumption.

The most striking facts are the relative importance of rolled zinc in Europe and of die casting in the U.S. and Britain. Almost everywhere galvanizing is the largest use of zinc.

The pattern in Europe also varies from country to country. Britain is most like America, and France, Belgium and Spain, which use over half their zinc for rolling, differ from it the most. In these three countries the smelters are also the rollers. Germany, which is the largest user after Britain, falls somewhere in between. There are various reasons for these differences. Thus rolled zinc is a traditional metal for roofing and rainwater goods in France, Belgium, Spain and Denmark and in most of Germany. In Europe the use of zinc to repair the many old zinc roofs helps to maintain the demand; some 87% of all the roofs in Paris for instance are zinc. The second largest use of rolled zinc is for battery cans, and in Britain this is the principal use. Mason jar caps are practically unknown in Europe. Most European sheet zinc is pack-rolled and there is little demand for strip.

Galvanizing, unlike zinc rolling, is steadily increasing, although its

growth has been somewhat hampered in recent years by the steel shortage, and it is only recently that steel and zinc have both been plentiful. Jobbing galvanizing, which includes hollow-ware, accounts for about a third of the European total. Sheet, wire and tube galvanizing is largely in the hands of steel producers, and has suffered from the vicissitudes to which the European steel industry has been subjected. In Britain production has only recently been free to rise. Galvanized sheet is less used in Europe for fabricating into hollow-ware and for roofing than it is on the American continent and in other newer countries. Strip galvanizing has not yet assumed the importance that it has in the U.S. and there are only four lines in Europe - two in Britain and two in France.

In spite of the talk of rivalry from aluminium coatings, and of processes for hot dip aluminizing, they do not yet show much sign of becoming a serious threat in Europe. Aluminium sheets for roofing are also less popular than in America.

Galvanizers all over Europe are among the most aggressive of zinc users, and cooperate with each other to a remarkable extent. An interesting and important development in Britain has been the widespread adoption of galvanizing to rust-proof the steel windows which are used in most new buildings; over 95% of all the steel windows made are protected in this way. The galvanizing is mainly carried out in mechanized plants operated by the window manufacturers.

Outside the U.S.A., zinc alloy die casting has only become an important use of zinc in Britain, when the annual consumption during the war reached 50,000 tons. It is used to a lesser extent in France, Switzerland and Italy. British die casting declined at the end of the war, but was recovering well until it was checked by the zinc shortage and rising prices. In Europe the choice of zinc or aluminium depends more on price than in America, because wage costs are lower and the cost of the metal accounts for a larger proportion of the final price. Since most European die casters are smaller than those in America and cannot afford such

elaborate testing equipment, the industry continues to be worried to some extent by the contaminated products of indifferent firms. France has recently introduced a Certification Scheme similar to that of the American Die Casting Institute, and another is being prepared in Britain through the British Standards Institution.

Brass is still relatively much more important in Britain than in the U.S. On the Continent its production was severely curtailed by war-time shortages of copper, especially in Germany, and so it has lost some ground to other materials, such as aluminium alloys and zinc plated steel. Nevertheless the industry is still very active. Consumption of virgin zinc for brass is unlikely to rise much, however, because of the importance of recovered scrap.

Zinc oxide, another old established use of zinc, is made in several countries by zinc producers as well as by independent manufacturers; there was naturally a good demand in the immediate post-war period when much repainting was needed. However, recently its use has declined sharply, particularly in paints, owing to competition from other pigments which have not suffered so much from shortages and price variation.

There is no detailed information available about zinc wire and zinc dust, which have therefore been ignored in my survey. They account for only a few percent of the total virgin zinc consumption.

V. THE OUTLOOK

In a paper of this nature it is usual to give some forecasts of future production and consumption. They are however difficult to make for 1953 because of the present uncertainty about price. A small surplus could cause a substantial fall, just as the recent shortage (which was at the most only a few percent) led to abnormally high prices. Most European producers are mainly suppliers to home markets whose requirements they seldom meet in full and so price changes may affect them less than others since there is a tendency for most countries to

strive for self-sufficiency. The following estimates have therefore been made on the assumption that any cuts in production, caused by declining prices, would at the most be very small and would be mainly confined to the few countries with exportable surpluses.

Mine production in 1953 seems likely to be some 40-50,000 tons higher than in 1952, mainly owing to increases in the French African territories. In most other countries production should be about the same as in 1952, although a few small high cost mines may be forced to close.

Smelter production in 1953 should also be higher than in 1952 as the result of new capacity coming into operation but there may be small reductions in exporting countries such as Belgium, pending a revival of demand. If the consumption rises above the 1952 level the relative dependence of Europe on imports of zinc metal may be about the same as it was then but net exports of zinc concentrates will probably be less.

Consumption. The course of consumption is far more difficult to forecast since statistics ignore the level of stocks, an important factor. The high figures for consumption for 1950 and 1951 probably reflect the tendency for consumers to over-buy during a period of rising prices and the low figures in 1952 to some extent indicate the running down of stocks on a falling market. The index of industrial production and the rate of steel consumption in Europe have shown no such variations in these years and so the level of actual zinc consumption was probably somewhere in between the extreme figures reported for the last three years. Another factor not to be overlooked is the effect that the recent very high prices in Europe will have had on future consumption for no doubt some consumers then found substitutes which they will go on using. However, perhaps the high prices will prove to have been less serious in Europe than in other parts of the world since they mainly affect uses such as

die casting, which account for relatively less metal in most European countries than in the U.S. for example. The use of zinc for brass making may however be affected. When all these factors are taken into account it is not unreasonable to estimate the rate of consumption for 1953 as at least 660,000 tons compared with 617,000 tons in 1952 and 713,000 tons in 1951. Defence requirements still form part of our consumption.

Production and consumption in Europe are to-day not far out of balance and since Britain, the biggest European consumer, draws supplies from outside Europe, other countries are likely in times of surplus to want to try to expand their exports outside Europe.

What are the prospects for increasing the consumption of zinc in Europe? No doubt you will have noticed in comparing the U.S. with Europe that though we have twice the population we use less zinc. The least developed use of zinc in Europe is die casting, which in your country accounts for almost one-third of your total consumption, and we use relatively less zinc than you for all other purposes except rolling. The prospects therefore seem to be good, since with the development of Africa and the Middle East there should be a large demand for consumer goods which Europe is best placed to supply. But it is clear that with the growing competition from the newer metals the consumption of zinc can no longer be expected to expand without a special effort on the part of the industry. In this respect it is worth noting that die casting is the only important new use for zinc which has been developed in the last 100 years and that even now it is a major consumer of zinc only in the U.S. and Britain, thanks to the enterprise and the energy of The New Jersey Zinc Company and The Imperial Smelting Corporation, Ltd.

In conclusion I propose to say something of the work we are doing to increase consumption in Europe. In Britain the Zinc Development Association is the central body for development work. It is supported by the Commonwealth

zinc industry, including all the smelters, most of the leading mines and the leading consumers in Britain and many in the Commonwealth. The Z.D.A. may perhaps be said to combine the functions of the American Zinc Institute with those of the American Die Casting Institute and the American Hot Dip Galvanizers Association. We have very friendly relations with producers and consumers all over the world and have organized galvanizing conferences in Europe with the object of increasing the exchange of information. With the same aim we have also sent British and European teams of experts to other countries.

All this work is done to increase interest in zinc and so promote its use and it is backed up by the publication of booklets, and abstracting and library services and other technical work. For example the members of our Die Casting and Galvanizing Associations co-operate in seeking new uses and solving common problems. The Z.D.A. staff, which includes metallurgists, chemists and experts in building and engineering, is able to deal immediately with inquiries that come in not only from Britain and the Commonwealth but from all over the world. The Association does no laboratory work of its own but is in close touch with that done by private firms and by Government sponsored bodies and is often able to suggest fruitful lines of investigation.

On the Continent there are central organizations doing similar work in both France and Germany, though they operate on a rather smaller scale. In Italy too some of the producers have been active in promoting new uses.

There is already close collaboration between consumers in Europe, particularly galvanizers and die casters, and we hope that there will soon be a combined effort made on behalf of zinc which will eventually lead to a handsome increase in consumption. But the way is not easy since the zinc industry is made up of many units - for example, independent mines, smelters and consumers whose different points of view sometimes prevent them from recognizing their common interests. If zinc is to continue to make good headway in Europe and all over the world our efforts must at least match those made on behalf of the new metals, whose producers are often the main consumers and so can more readily appreciate the value of expenditure on market research and development work.

APPENDIX 1 - ZINC MINE PRODUCTION IN WESTERN EUROPE

Recoverable basis - thousands of metric tons

COUNTRY	1913	1938	1947	1948	1949	1950	1951	1952	Estimated 1953
Austria			1	2	2	3	4	5	5
Britain	6	12	-	-	-	-	-	-	-
France	13	-	6	5	11	10	10	12	13
Finland	-	-	2	3	3	2	3	3	3
Germany	250	220	25	35	58	69	75	80	85
Greece	11	5	1	2	2	3	4	5	4
Italy	64	93	58	74	73	87	100	102	105
Norway	-	-	4	5	5	5	5	5	10
Spain	67	41	44	43	52	65	73	69	67
Sweden	17	35	39	26	29	28	29	28	30
Yugoslavia	-	41	22	28	15	57	55	45	45
Poland	-	64	-	-	-	-	-	-	-
Others	4	16	-	-	5	5	5	5	5
Belgian Congo	-	4	41	47	59	75	89	88	90
French Oversea Territories	39	12	10	10	13	20	29	36	64
Total Europe & French & Belgian Territories	471	543	253	280	327	429	481	483	526
U. S.	370	469	567	564	530	566	616	600	
Rest of World	439	798	836	878	945	1058	1082	1217	
World Total (Free world from 1947)	1280	1810	1656	1722	1802	2053	2179	2300	

APPENDIX 2 - ZINC METAL PRODUCTION IN WESTERN EUROPE

Thousands of metric tons

COUNTRY	1913	1938	1947	1948	1949	1950	1951	1952	Estimated 1953
Austria	28	-	-	-	-	-	-	-	-
Belgium	204	210	133	152	177	177	201	182	170
Britain	59	56	69	73	65	72	75	69	75
France	68	61	45	56	61	72	75	80	85
Germany	281	194	21	43	93	142	156	151	155
Holland	24	25	10	14	17	19	23	25	24
Italy	-	34	24	27	27	38	47	55	67
Norway	9	47	35	42	41	43	40	40	42
Spain	7	8	20	21	20	21	21	21	21
Sweden	2	-	-	-	-	-	-	-	-
Yugoslavia	-	11	-	2	9	11	12	12	12
Poland	-	110	-	-	-	-	-	-	-
Total Europe*	682	756	357	430	510	595	650	635	651
U. S.	320	540	782	771	789	826	845	872	-
Rest of World	13	286	322	366	375	398	416	653	-
World Total (Free world since 1947)	1015	1582	1461	1567	1674	1819	1911	2160	-

* Production from the new smelter in Belgian Congo starting this year not included, since it may not come to Europe.

APPENDIX 3 - APPARENT CONSUMPTION OF REFINED ZINC IN WESTERN EUROPE

Thousands of metric tons

COUNTRY	1913	1938	1947	1948	1949	1950	1951	1952	Estimated 1953
Austria	40	-	3	2	5	6	7	5	
Belgium	83	87	50	78	70	65	105	56	
Britain*	195	212	227	226	202	241	191	172	
Denmark	-	-	5	6	7	6	6	5	
France	85	88	105	94	110	96	113	109	
Germany	232	269	25	61	99	157	152	145	
Holland	4	12	16	20	21	24	15	15	
Italy	17	34	26	21	28	34	44	32	
Norway	-	-	11	12	12	11	12	12	
Spain	6	8	20	21	20	22	22	21	
Sweden	10**	20**	20	20	23	22	20	19	
Switzerland	-	7	11	14	8	11	15	14	
Yugoslavia	-	7	-	-	8	8	8	9	
Czechoslovakia	-	13	-	-	-	-	-	-	
Others	-	-	2	2	3	3	3	3	
Poland	-	40	-	-	-	-	-	-	
Total Europe	672	797	521	577	616	706	713	617	
U. S.	320	540	713	732	638	877	805	770	
Rest of World	17	332	316	311	346	382	407	-	
World Total	1009	1669	1550	1630	1590	1965	1925		

* Actual Consumption.
** Including Denmark and Norway.

APPENDIX 4 - EUROPEAN ZINC PRODUCING COMPANIES

BELGIUM

Sté An. des Mines et Fonderies de Zinc de la Vieille-Montagne.
Cie des Metaux d'Overpelt-Lommel et de Corphalie.
Sté An. Metall. de Prayon.
Sté An. de Rothem.

BRITAIN

Imperial Smelting Corporation Ltd.

FRANCE

Sté An. des Mines et Fonderies de Zinc de la Vieille-Montagne.
Cie Royale Asturienne des Mines.
Sté Min. et Metall. de Penarroya.

GERMANY

Unterharzer Berg & Hütten Werke.
Stolberger Zink A.G. für Bergbau & Huttenbetrieb.
A.G. des Altenbergs fur Bergbau & Zinkhütten Betrieb.
"Berzelius" Metallhütten G.m.b.H.
Metallwerke Unterweser A.G.

HOLLAND

Sté An. des Zincs de la Campine.

ITALY

Societa di Monteponi.
Societa Mineraria & Metalurgica di Pertusola.
Sta Montevecchio Italiana dei Piombo e dello Zinco.

NORWAY

Det Norske Zinkkompani.

SPAIN

Cie Royale Asturienne des Mines.

YUGOSLAVIA

Cinkarna d. d.

RECEIVED
APR 17 1952
WESTERN MINING DEPT.

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

April 16, 1952

AIR MAIL

Mr. D.J.Pope, General Manager
Western Mining Department
Salt Lake Office

DEMING MILLING UNIT
Flotation of Oxidized
Zinc Ores

Dear Sir:

This refers to your letter of April 14th on the above subject.

The sample of oxidized zinc ore Mr. Kaanta has been testing comes from a prospect owned by Mr. Lawrence Yacomo, in the Helvetia District South of Tucson.

Mr. Kaanta and Mr. Stephens have a date this week-end with Mr. Yacomo to visit the property. Mr. Stephens has previously visited the Mohawk Prospect in this district, which has similar oxidized zinc ore showings, and it is quite probable that Mr. Yacomo has control of this or a nearby prospect.

The Mohawk Prospect has a number of irregular and scattered oxidized zinc showings of fair grade but narrow width. In 1943 the Bureau of Mines drilled six holes in hopes of finding sulphide ore downdip along these fracture zones; however, the results were negative (R.I.3958, October 1946). It would appear therefore that the prospect of sufficient tonnage here to justify an oxidized zinc plant are not good. There might be enough to justify shipping to Deming if a recovery process could be worked out there with little capital investment.

Mr. Kaanta advises me he has 600 pounds of sample from Macomo's prospect at Deming, so he no doubt could supply a sample for test elsewhere if this is thought advisable.

Very truly yours,

F. V. RICHARD

cc: CFPollock
WRLandwehr
NWeiss
DRPurvis
HWKaanta

FVR:blc

W. R. L.
" 17 "

WESTERN MINING DEPARTMENT
Salt Lake City, Utah

April 14, 1952

AIR MAIL

Mr. F. V. Richard, Manager
Southwestern Mining Division
American Smelting and Refining Company
813 Valley National Building
Tucson, Arizona

DEMING MILL
FLOTATION OF OXIDIZED ZINC ORE

Dear Sir:

From a telephone conversation with Mr. Kaanta, Mr. Weiss learned that he is working on flotation of oxidized zinc ores and I understand has made something like a 31% zinc concentrate and has asked Mr. Welch whether or not the Smelting Department would be interested in receiving this concentrate.

Of course, we are interested in working on oxidized zinc ores if there is any ore body or any other tonnage of this material available. If it is true that there is such an ore body, then we would like to be informed of it. As a matter of fact, if there should be any appreciable tonnage of oxidized zinc ore available, then no doubt it would be good business to acquire this if we could do so on a reasonable basis.

It so happens that a foreign company with whom we have had business relations from time to time wrote to Mr. Goodwin some time ago and told him that they had a process worked out for concentration of oxidized zinc ores and offered to do work on a sample for us if we had any of these ores available. This problem was put up to Mr. Landwehr and the rest of the Exploration Department, but no one could suggest where there was any appreciable tonnage of ore of this type available in this country. If anyone in your organization knows of such an ore body, then Mr. Landwehr should be advised of it so that arrangements can be made for us to supply a sample to this foreign company as requested by Mr. Goodwin.

In view of all the above, please advise what the circumstances are about these tests referred to.

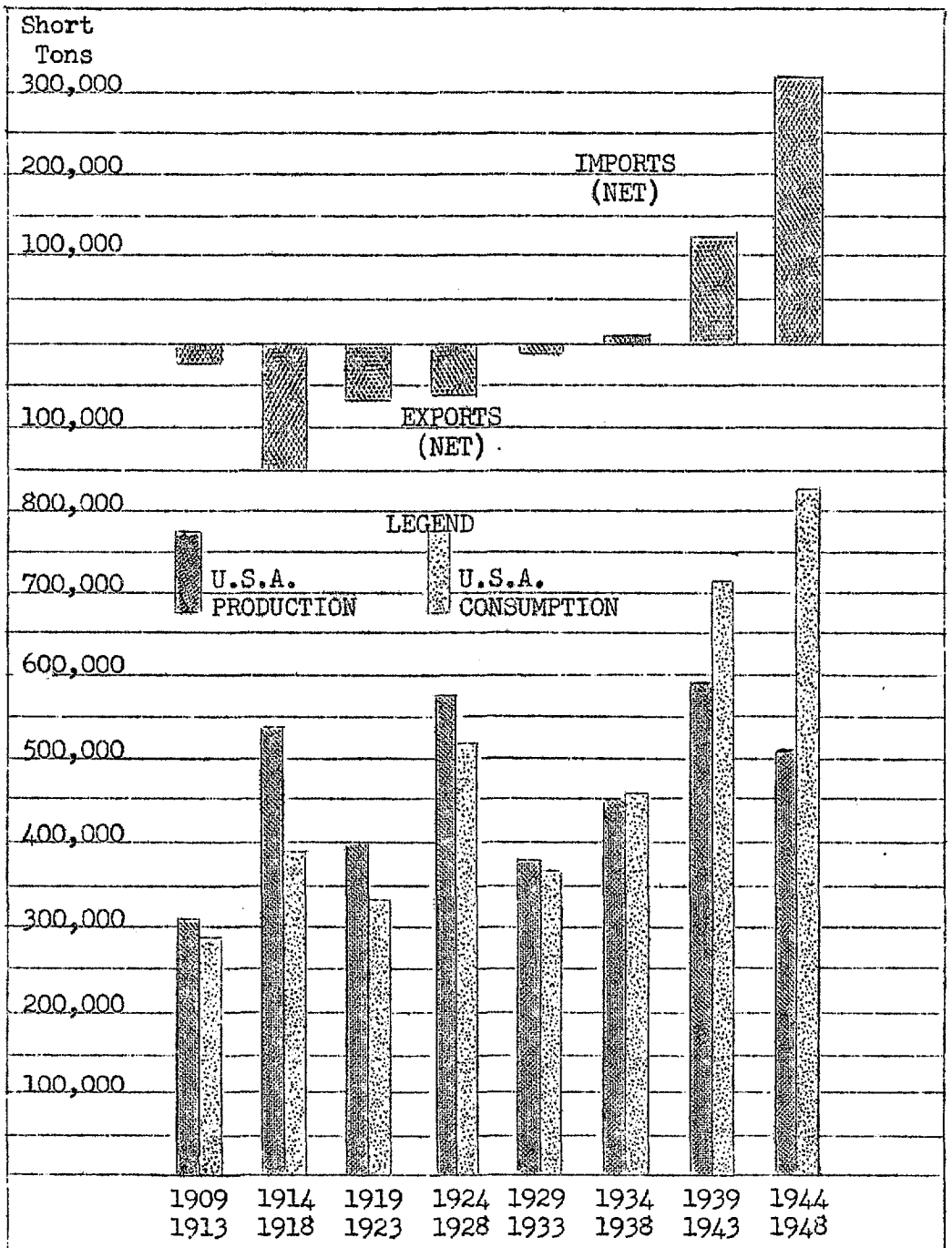
Yours very truly,

ORIGINAL SIGNED BY
D. J. POPE

D. J. POPE

DJP:bm
cc: C.P.Pollock
W.R.Landwehr
N.Weiss
D.R.Purvis
H.W.Kaanta

W. R. L.
APR 14 1952



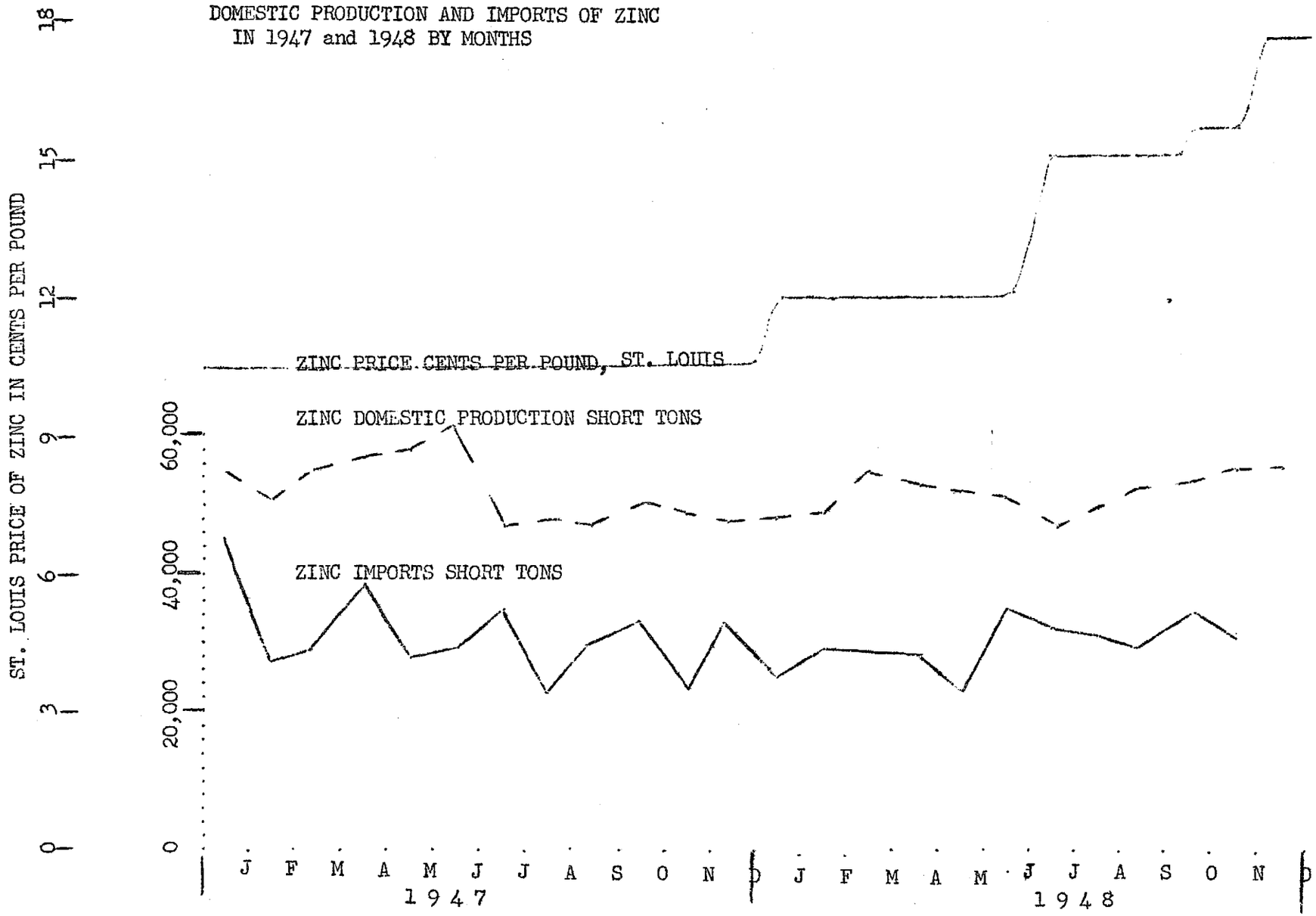
ZINC PRODUCTION AND CONSUMPTION OF THE UNITED STATES.
NET EXPORTS AND IMPORTS.
5--Year averages.
1909 - 1948.

Source: Mineral Resources; Minerals Yearbook

FIG. 4

Zinc

DOMESTIC PRODUCTION AND IMPORTS OF ZINC
IN 1947 and 1948 BY MONTHS



Compliments of Colorado Mining Association

Mrs. Deline for copy to Mr. O'Brien

11

SELBY PLANT

San Francisco, California
April 20, 1949

MEMO TO: MR. W. S. REID

Mr. Kenyon Richard was called upon on April 19, 1949, by Mr. W. B. Beatty, a geologist now working for the Stanford Research Institute, who advised him that the Institute is now working on a process for the recovery of metallic zinc from zinc oxide ores.

The company sponsoring this project is the Basic Reduction Company, Lead and Zinc, P. O. Box 888, Henderson, Nevada, who have leased a portion of the Basic Magnesium Plant. According to Mr. Beatty the process consists of a caustic leach of the ores, followed by electrolysis to produce powdered metallic zinc.

The Stanford Research Institute is checking the pilot plant work and Mr. Beatty is assigned to determine possible sources of zinc oxide in the Southwest. Mr. Richard asked Mr. Beatty about combination of lead and zinc ores and it was indicated that a separation could be made. The company believes this process will be economic for ores carrying as little as 20% zinc in oxide form.

GEORGE H. PLAYTER

GHP:EC

cc: KRichard
WRLandwhr
WSReid 6)

O. J. P

APR 26 1949

W. R. L.
APR 22 1949

L. H. H.
APR 2. 1949

READ AND RETURN

DJP	✓	
JFJ		
LHH	✓	
NW		

MINING DEPARTMENT
Received
APR 22 1949

Note	Handle	Return	And Return	And Advise	File

January 20, 1947

The Chairman
Committee for Reciprocity Information
Washington, D.C.

Subject: Trade Agreement Negotiations with Australia, Belgium, Brazil, Canada, Chile, China, Cuba, Czechoslovakia, France, India, Lebanon (Syro-Leganese Customs Union), Luxembourg, Netherlands, New Zealand, Norway, Union of South Africa, Union of Soviet Socialist Republics, United Kingdom.

Products: Zinc-bearing Ores; Blocks, Pigs and Slabs; Sheets; Dust; Old and Worn-Out Zinc, Dross and Skimmings; Zinc Oxides; and Lithopones.

Statement of: Otto Herres, Vice President
Combined Metals Reduction Company
Director, Utah Mining Association

Dear Sir:

In my brief submitted December 12, 1946, attention was called to the harm further tariff reductions on raw materials, especially zinc, would do to business in the Western states. Communities supported by mines, farms, fields and forests require protection against imports of cheap foreign labor and lower living standards.

Reference was made to conclusions of the U.S. Bureau of Mines to the effect that tariff reductions on zinc mean lowering of wages for workers and mining only high grade ore which is wasteful and detrimental to the long-time public interest. The alternative is loss in part of domestic zinc markets to foreign producers and an aggravated unemployment problem.

Also cited was the report of the Tariff Commission to Congress in May, 1945, estimating that a cut in duties would decrease the value of home production of zinc far more in dollar value than the amount of the increase in imports. Thus American workers would be injured without materially aiding foreign trade.

It was pointed out that the miners' union is advocating subsidies and nationalization of the nonferrous mining industry for the purpose of providing employment for its workers and maintaining adequate wages. Tariff reductions that cause intensive competition with imports of low foreign wage scales mean increased political pressure for government assistance and agitation for intervention in economic affairs.

Reference was made also to the studies of the Economics and Statistics Branch of the U.S. Bureau of Mines estimating statistical reserves of zinc in the United States at nineteen years' supply. The President in his message to Congress on January 6, 1947, stated, "I must advise the Congress that we are rapidly becoming a 'have not' nation as to many of our minerals. The economic progress and security of our country depend upon an expanding return of mineral discovery and upon improved methods of recovery. The Federal Government must do its part to meet this need."

The way for the Federal Government to do its part in expanding a return of mineral discovery and increasing our nineteen years' supply of zinc is not cutting tariffs to close down mines and throw miners out of employment. A better method is to offer an incentive for exploration and development of mines producing copper, lead, zinc and essential minerals, and some inducement for prospecting and for initial production of metals. Mineral discoveries add to our productive resources and create new national wealth.

Undoubtedly the zinc industry will be among the first to feel the disastrous impact of tariff reductions. Before the war it was facing partial liquidation in consequence of duty decreases early in 1939. Abnormal war requirements and pent-up demand have relieved the competitive pressure but only temporarily. Much is being said now about a depression of uncertain extent in the period immediately ahead. Probably no other substantial industry sets up a chain reaction of increasing employment more far-reaching than the production of metals from the complex ores of copper, lead and zinc. Commencing with prospecting and exploration there is development of mines, construction of towns and villages to provide living facilities for workers, mining the ore, milling for concentration, smelting, refining the metals and finally fabrication and manufacture. These operations require and support transportation by rail, water, highway and air; supplies, equipment, services and provision for the needs of employees in food, clothing, housing and services. Studies show that for every ton of zinc imported in the form of concentrates the loss in employment in the Rocky Mountain area amounts to 16.58 man shifts for mining and milling zinc ore and smelting the lead and iron concentrates produced in the milling process. Including the service industries dependent on this work, total employment increases to 55.26 man shifts per ton of zinc produced, representing support for one day of approximately 196 workers and dependents. In case of the importation of 100,000 tons of zinc per year to displace Rocky Mountain production, 65,000 people would be deprived of livelihood (that is, 100,000 times 196 divided by 300 working days in a year equals 65,000). This does not take into account losses by other areas because of western markets destroyed by competitive imports.

The zinc industry, remembering the experience of 1938 tariff reductions to Canada which brought in zinc from Mexico, has little confidence that it will receive any support or assistance from the State Department in its struggle to survive the coming trade treaty negotiations. Consequently the C.I.O. Mine, Mill and Smelterworkers Union which bargains for 160,000 workers in over 600 mines and plants of the nonferrous metals industry, strongly advocates subsidies to mine operators for the purpose of providing employment at wages adequate to maintain American living standards. Recently, because of the uncertain political fate of the subsidy program, the Union turned its sights toward nationalization of the nonferrous mining industry.

Zinc is mined widely in states all across the country from New York to California. Hundreds of mines are dependent upon and urge the continuation of the premium price plan of subsidy payments for existence. This is a consequence of ceiling prices established by O.P.A. during the war, war manpower shortages and lack of opportunity to extend their ore reserves during years when every effort had to be centered on production of metal for the Arsenal of Democracy.

It should be plainly evident that decreases already made in the duties on zinc, regardless of proposed cuts, will result in political pressures for government assistance from organized labor and mines made marginal by tariff reductions and production for defense as well as communities dependent upon them for support. Will tariff reductions to that end increase world trade?

Obviously full employment is not to be gained by dislocating our indus-

trial system in order to collect foreign loans by means of imports made at the expense of domestic producers. World trade will be served better by keeping America prosperous.

We therefore again respectfully recommend for your consideration that no further reductions shall be made in the duties of the zinc schedules and urge in the national interest that the 1930 tariff rates of the zinc schedules be restored.

January 20, 1947

The Chairman
Committee for Reciprocity Information
Washington, D.C.

Subject: Trade Agreement Negotiations with Australia, Belgium, Brazil, Canada, Chile, China, Cuba, Czechoslovakia, France, India, Lebanon (Syro-Leganese Customs Union), Luxembourg, Netherlands, New Zealand, Norway, Union of South Africa, Union of Soviet Socialist Republics, United Kingdom.

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In my brief submitted December 12, 1946, attention was called to the harm further tariff reductions on raw materials, especially zinc, would do to business in the Western states. Communities supported by mines, farms, fields and forests require protection against imports of cheap foreign labor and lower living standards.

Reference was made to conclusions of the U.S. Bureau of Mines to the effect that tariff reductions on zinc mean lowering of wages for workers and mining only high grade ore which is wasteful and detrimental to the long-time public interest. The alternative is loss in part of domestic zinc markets to foreign producers and an aggravated unemployment problem.

Also cited was the report of the Tariff Commission to Congress in May, 1945, estimating that a cut in duties would decrease the value of home production of zinc far more in dollar value than the amount of the increase in imports. Thus American workers would be injured without materially aiding foreign trade.

It was pointed out that the miners' union is advocating subsidies and nationalization of the nonferrous mining industry for the purpose of providing employment for its workers and maintaining adequate wages. Tariff reductions that cause intensive competition with imports of low foreign wage scales mean increased political pressure for government assistance and agitation for intervention in economic affairs.

Reference was made also to the studies of the Economics and Statistics Branch of the U.S. Bureau of Mines estimating statistical reserves of zinc in the United States at nineteen years' supply. The President in his message to Congress on January 6, 1947, stated, "I must advise the Congress that we are rapidly becoming a 'have not' nation as to many of our minerals. The economic progress and security of our country depend upon an expanding return of mineral discovery and upon improved methods of recovery. The Federal Government must do its part to meet this need."

The way for the Federal Government to do its part in expanding a return of mineral discovery and increasing our nineteen years' supply of zinc is not cutting tariffs to close down mines and throw miners out of employment. A better method is to offer an incentive for exploration and development of mines producing copper, lead, zinc and essential minerals, and some inducement for prospecting and for initial production of metals. Mineral discoveries add to our productive resources and create new national wealth.

Undoubtedly the zinc industry will be among the first to feel the disastrous impact of tariff reductions. Before the war it was facing partial liquidation in consequence of duty decreases early in 1939. Abnormal war requirements and pent-up demand have relieved the competitive pressure but only temporarily. Much is being said now about a depression of uncertain extent in the period immediately ahead. Probably no other substantial industry sets up a chain reaction of increasing employment more far-reaching than the production of metals from the complex ores of copper, lead and zinc. Commencing with prospecting and exploration there is development of mines, construction of towns and villages to provide living facilities for workers, mining the ore, milling for concentration, smelting, refining the metals and finally fabrication and manufacture. These operations require and support transportation by rail, water, highway and air; supplies, equipment, services and provision for the needs of employees in food, clothing, housing and services. Studies show that for every ton of zinc imported in the form of concentrates the loss in employment in the Rocky Mountain area amounts to 16.58 man shifts for mining and milling zinc ore and smelting the lead and iron concentrates produced in the milling process. Including the service industries dependent on this work, total employment increases to 55.26 man shifts per ton of zinc produced, representing support for one day of approximately 196 workers and dependents. In case of the importation of 100,000 tons of zinc per year to displace Rocky Mountain production, 65,000 people would be deprived of livelihood (that is, 100,000 times 196 divided by 300 working days in a year equals 65,000). This does not take into account losses by other areas because of western markets destroyed by competitive imports.

The zinc industry, remembering the experience of 1938 tariff reductions to Canada which brought in zinc from Mexico, has little confidence that it will receive any support or assistance from the State Department in its struggle to survive the coming trade treaty negotiations. Consequently the C.I.O. Mine, Mill and Smelterworkers Union which bargains for 160,000 workers in over 600 mines and plants of the nonferrous metals industry, strongly advocates subsidies to mine operators for the purpose of providing employment at wages adequate to maintain American living standards. Recently, because of the uncertain political fate of the subsidy program, the Union turned its sights toward nationalization of the nonferrous mining industry.

Zinc is mined widely in states all across the country from New York to California. Hundreds of mines are dependent upon and urge the continuation of the premium price plan of subsidy payments for existence. This is a consequence of ceiling prices established by O.P.A. during the war, war manpower shortages and lack of opportunity to extend their ore reserves during years when every effort had to be centered on production of metal for the Arsenal of Democracy.

It should be plainly evident that decreases already made in the duties on zinc, regardless of proposed cuts, will result in political pressures for government assistance from organized labor and mines made marginal by tariff reductions and production for defense as well as communities dependent upon them for support. Will tariff reductions to that end increase world trade?

Obviously full employment is not to be gained by dislocating our indus-

trial system in order to collect foreign loans by means of imports made at the expense of domestic producers. World trade will be served better by keeping America prosperous.

We therefore again respectfully recommend for your consideration that no further reductions shall be made in the duties of the zinc schedules and urge in the national interest that the 1930 tariff rates of the zinc schedules be restored.

ZINC MINING IN THE WESTERN STATES

by

James K. Richardson, Manager
Utah Mining Association

The hope of our industry in refuting "have not" theories, with respect to zinc, lies, in my opinion, in the West. There is little question in the minds of those who have attempted to inform themselves as to the mine production possibilities and probabilities of western mines that our 1947 record production of zinc will be exceeded in 1948. The future, beyond 1948, is even more optimistically evaluated. Our attainment of these speculative production goals is not wishful thinking — the zinc is there! The failure, on our part, to place this zinc in market channels will be due to circumstances largely beyond the control of individual operators. Those factors which will influence our immediate and long range productivity are, largely, failures of our industrial system whose correction, of necessity, is ultimate but slow. I refer, specifically, to the inequities of distribution and inadequate zinc milling and reduction facilities in the West.

The relatively low return received by the western zinc mine operator for zinc produced has been a definite deterrent in the objective search for the mineral. In order that this statement be fully appreciated by those unfamiliar with our problem, I am taking the liberty of injecting into this paper some data recently calculated on shipments of about 4,000 tons of Utah ore:

	AG	Pb	Zn	Cu & Au
Metal Price	90¢	15¢	12¢	
Average Assay Value	13.97 oz.	9.59%	8.31%	Trace
Net return/ton	$10.21	$19.54	$4.94	$0.50
% of total net return	29.0%	55.0%	14.5%	1.5%
Net value per lb or oz of assay	73.1¢	10.2¢	2.9¢	——
Net return in % of market price	81.2%	68.0%	24.1%	——

It can, from the above, be seen that we have been, basically, a producer of

by-product zinc in the West. It is a by-product, principally, of silver-lead mining. Therefore, our production of zinc, if only the same stimulus is present, will largely be determined by the price of lead and silver rather than by zinc prices. Conversely, however, we can say that silver-lead production is, to a degree, controlled by zinc for through flotation processes our zinc recovery provides a certain amount of money to permit our mining of lower grades of silver-lead ores. In the particular case cited above, the zinc production represented more than the profit margin.

This relatively low return is due, primarily, to the freight charges between mine and ultimate consumer -- all of which must be borne by the mine operator. We, in the West, are, therefore, exceedingly grateful to the American Zinc Institute for their work, as well as that of others in the non-ferrous industry, for their splendid rate presentations which resulted in an exception in contemplated rate increases being made on movements of copper, lead, and zinc ores and concentrates.

We cannot foresee a situation in the immediate future, however, where our return per pound of contained zinc will be materially increased. The additional interest being evidenced in zinc fuming plants coupled with united action with respect to freight rates lead us to believe that the net return of, perhaps, one cent more per pound of zinc is in the realm of possibility.

In any assessment of future zinc production possibilities of the West, cognizance should be taken of past prospecting and exploration procedures. The search for western minerals has, historically, been for alluvial gold, quartz gold, silver, lead and copper in about that order. Zinc has come in as an uninvited but, at present, welcome guest. Historically, zinc has not always been an agreeable travelling companion accompanying our other minerals in the West. Today, however, the situation is different and under favorable conditions it is reasonable to anticipate greater activity in searching for zinc through outcroppings as well as through the media of geologic science. Experience, in many

western mining districts, indicates zinc at depth and geologic theories with respect to deposition are already being propounded and proven. We can, therefore, reasonably expect discoveries of new deposits as well as the disclosure of new zinc-lead-silver ore bodies in existing properties as exploration goes to greater depths.

Probably the greatest potential deterrent facing the mines of the West is the problem posed by labor. Mines are only now beginning to have sufficient manpower for the handling of available jobs. This situation, while gratifying at the moment, is not expected to be stabilized and labor shortages are anticipated in many western states. This feeling of impending shortages is brought on by the announced policies of many industrial organizations to transfer substantial portions of their operations into the West. There is also the competition of governmental projects designed to "develop the West" whose "cost plus" wage scales are entirely beyond the realm of our abilities to pay. The manning of these plants and work projects will, necessarily, be a drain upon labor currently employed in existing industries. The factor of "labor inefficiency" is present in our mines as it is all over the country. While some operators report minor improvements along this line, the vast majority are greatly concerned at the consistent decreasing trend in individual productivity despite mechanization developments. The incentive pay plans for increasing individual productivity have been reasonably effective, but these systems are under fire from the IUMMSW, our major union, at the present time. I cannot but "view with alarm" the obvious "party line" methods being employed to create class hatred, non-cooperation and distrust between employer and employee which is designed to strategically cripple the production of critical minerals at this time.

The western mine operator has, largely, forcibly expressed himself in opposition to the reenactment of a subsidy plan in the form administered during the war period. His basic reason is that he feels that the old plan was, in fact, a profit control plan directly opposed to his conception of the principles of free

enterprise. There was, in his opinion, no incentive given therein for the efficient operation of a property and that its administration actually fostered inefficiencies. The Premium Price Plan, in his opinion, contained within its body the foundation of governmental control and operation of an industry which reached its present stage of development because of the individual initiative and courage of men whose whole philosophy is based upon self-reliance. The western miner is insistent that any form of government aid must not take from him his independence of action in the mining and search for ore.

During the war emergency, long range development was discouraged and in many cases forbidden. The vast majority of the mines in the West are now faced with the problem of doing long delayed exploration as well as prosecuting normal exploration. Today the cost of this work has increased tremendously and sufficient capital could not be retained under this profit control system to offset these cost differences. There appears, therefore, to be a logical reason behind his acceptance of the principle of governmental aid insofar as development and exploration work is concerned. Even here, however, there is willingness to match funds with the government to back up individual judgment as well as minimizing inefficiencies. Many operators favor an "all out" subsidy program and have thrown caution to the wind. Others fear that the continuing promise of government aid acts as an insidious narcotic in easing the pain of a planned nationalization. The western operator has, in his sincere desire to cooperate with his less fortunate neighbor, shown a disposition to compromise his position to the extent of agreeing to subsidies on marginal production in event that production all goes to the national defense stockpile. There is, however, a distinct plea for moderation in subsidy demands lest the fears of many operators be realized and their citadel of individualism be destroyed.

The western mine operator has, largely, failed to appreciate or recognize the threat posed the industry by the recent zinc re-importation measure proposed

by Senators McCarran and Cain. The institution of such a practice, it appears to me, will establish a very dangerous precedent. It threatens that portion of the zinc industry, reduction, that has so greatly contributed to the development of mines throughout our western country. It seems to be highly illogical in view of our present reduction capacity which is more than ample to adequately handle the production of our mines. It is to be hoped, however, that the leaders of this zinc industry will appreciate the fact that this hazard to their existence is present and will give serious thought toward relocating reduction facilities within the confines of their major source of concentrates and closer to newly developed western markets.

The fact that western operators have, in their 1948 estimates, indicated a continuation of the upward trend of zinc production from their mines is not wishful dreaming but is based on announced current operating programs. This statement may be questioned by those familiar with the fact that mine production in January of this year was, virtually, the same as the monthly averages for the last six months of 1947. Mines in the combined Western States produced an estimated total of 334,198 tons of zinc in 1947. Western mine operators indicate that they expect this same area to produce in the neighborhood of 369,500 tons in 1948. Upon what basis are these 1948 figures made?

The eight year history of annual record production in Arizona is expected to continue on through 1948. This will be due, largely, to the zinc production of the Phelps Dodge Corporation from its Bisbee operations. This operation has been, consistently, the ranking Arizona producer. Six years ago, there were practically no mills in Arizona making zinc-lead-copper-iron separations. Today there are about six mills taking custom ore, and four large mills treating their own ores. Also, since January 1st, the new mill of the Athletic Mining and Milling Company has become a producer. These facilities, easily available to the hundreds of small operators, cannot but increase production above that reported in 1947.

California's zinc production was hard hit by the expiration of the Premium Price Plan. Over 50% of their 1947 production came from a single mine which shut down on June 30, 1947. Their second largest producer of zinc also closed upon expiration of the plan. It is not anticipated that California will make a particularly impressive showing with respect to zinc in 1948.

Colorado showed an increase in January, 1948 above their monthly average in 1947. The major producer in Colorado, the Empire Zinc Company, indicates that their zinc production in 1948 will be about the same as for 1947. It is expected, however, that production from Summit County will be about double that which was produced in 1947 which will, in the main, offset production lost by the expiration of the Premium Price Plan. The Rico-Argentine which was, last year, the second largest zinc producer in Colorado is expected to duplicate its production performance in 1948. Colorado was, relatively speaking, one of the hardest hit of all the Western States when the Premium Price Plan expired due to the number of small operations within its boundaries, plus the fact that the operators there are placed at a tremendous disadvantage from the standpoint of transportation costs.

Idaho, will, apparently, continue to maintain its status as the top zinc producing state in the Nation. Zinc is the predominant metal produced in Idaho from a tonnage standpoint, with lead a close second. Zinc, in all likelihood, will hereafter gain a more prominent place in Idaho's annual mineral output because of recent discoveries and the development of major zinc-lead ore bodies. There has also come into existence several relatively new operations giving promise of important tonnages. The Pine Creek area has a tremendous undeveloped zinc potential and already two mines in the area have developed large and important ore bodies both from a tonnage and mineral value standpoint. The Day Interests, now known as Day Mines, Inc., have several producing mines and a large acreage of promising zinc mineralized ground. It is reliably reported that this organization's zinc production in 1948 will be materially increased. The announced plan of a block

caving system being worked out for the upper workings of the Bunker Hill mine does not give immediate promise but substantial tonnages of zinc ore will be produced in the future which will, in all probability, necessitate increasing existing milling facilities. The Star Mine, near Burke, is expected to duplicate its 1947 zinc performance as the top producer of zinc in the Coeur d'Alenes. Like Utah, Idaho has another outstanding "mine" in its old slag dumps and tailing piles which are being reworked. All in all, Idaho's future, insofar as zinc is concerned, is extremely bright due to the fact that deeper mine development has shown an increase in the zinc content of its ores which coupled with improved mill practice has made for highly desirable by-product zinc concentrates in the recovery of silver-lead values.

The enigma, insofar as my estimates are concerned, is Montana. There has been considerable variance in "guesses" by the crystal gazers in that area. Indications are, however, that there will be some increase in mine zinc production. This statement is based upon the fact that during the last six months of 1947 Montana's major zinc producer stepped up their output. This increase is being maintained and even enlarged. The annual figure, therefore, should be somewhat larger than that indicated during 1947, despite any losses which might have been attributed to a loss of premiums.

Nevada's production of zinc should remain practically the same as it was during 1947 with perhaps a moderate increase as labor becomes more readily available. It is reliably reported that some increase can be expected from the Pioche District due to the higher grades of ore being worked. Also worthy of mention is the anticipated zinc production from the Eureka area by Ventures. No production is immediately forthcoming from this latter operation but their shaft has reached the ore horizon and present development work should lead to production during the latter part of 1948.

New Mexico, which ranked as the third largest zinc producing state in 1947, is anticipated to show an increase in 1948. This increase will be due, primarily, to an anticipated stability of zinc prices during 1948. Some old tonnage is expected to be lost in the Magdalena District, but it will be offset by new production. Grant County will continue to provide the major zinc production of the state where existing operations have almost all developed new ore at depths or on extensions of old ore horizons. Exploration and development work has been, generally, accelerated. The old Pinos Altos District, which experienced a gold boom in 1852, gives promise, in the future, of becoming a substantial zinc producing area following geophysical work plus supplemental diamond drilling. To fully appreciate New Mexico's potential one must recognize the fact that in most of the old districts little work has been done at depth and several major operators are pushing diamond drilling programs in these areas.

Utah's mine production of zinc is anticipated to increase somewhat during 1948. This is largely due to an easing of manpower shortages, acceleration of development work during the latter part of 1947, improvement of milling facilities by one of the larger producers, and the construction of a mill at one of the old mines which previously contributed little zinc to market channels.

Ninety-seven per cent of Washington's zinc production came from five properties in 1947. The problem, therefore, in estimating their 1948 production lies, largely, in an analysis of the production programs of these operations. Pend Oreille Mines and Metals were operating their mill at about one-half capacity in December, 1947, but have shown a gain in capacity each month since that time. The limiting factor has been, apparently, insufficient mine tonnage but informed observers point out that mine and mill output should be in balance by midsummer and hold throughout the remainder of 1948. Grandview operations of the American Zinc, Lead and Smelting Company were limited somewhat by the availability of power, but a new power source has been made available and we are reliably informed

that their mill output will be from 30% to 40% greater in 1948 than in 1947. Metaline Mining and Leasing Company is almost wholly on development work at the moment but ore production is anticipated which will be milled at Grandview, utilizing the excess mill capacity resulting from adequate power. The Deep Creek mine of Goldfield Consolidated Mines Company is the only one of their properties producing at present; production from two others is expected during 1948. The mill capacity here was limited by power but adequate power is now available for normal expansion. The Chelan Division of Howe Sound Company is expected to maintain normal production of by-product zinc throughout 1948 which means a comparable production to that of war years or from two to three times that produced in 1947.

Besides these five properties in Washington there are approximately a half dozen smaller ones which promise a substantial increase in 1948. Each of these have mill plants and have either only recently commenced production or operated intermittently. Anticipated continuous operation at all of these should join with the production of the five aforementioned operations and materially increase the state's overall production above that of 1947.

I have, in this paper, not attempted to present my own views, but the aggregate thinking of a cross section of those men who make up the western zinc mining industry. These men, in their planning, must, of necessity, base their projects upon conditions that their past experience indicates are probabilities. Naturally enough, their estimates are based on what they consider normal situations and would become obsolete in event of war or severe recessions in business activity. The recently announced 2½¢ increase in lead prices will, unquestionably, increase zinc production in the West. A severe, and prolonged, labor disturbance would, just as effectively, place these estimates in the category of wishful thinking. I feel exceedingly humble in presenting their thoughts to you and gratefully acknowledge the help they have given in the preparation of this paper.

I do, however, reiterate my original opinion that the West holds, within its confines, a promise of zinc production unmatched by any other domestic region. The fulfillment of this promise can only be attained through the realistic approach to and appreciation of the West's particular problems. The thinking of this entire industry must be broadened in scope until it encompasses national well being and relegates to the background regional ideologies, idiosyncrasies, and tragedies. We must look to the future with confidence if we are to inspire trust among our people in our abilities to meet future tests upon our national strength. A statement in the New Testament seems particularly pertinent: "The harvest is truly plenteous, but the laborers are few". In our bountiful land our harvest of zinc gives great promise, but we must all be laborers and work, earnestly and confidently, if we are to maintain our ideals of national selfsufficiency.

2/m

COMBINED METALS REDUCTION COMPANY
218 Felt Building
Salt Lake City, Utah

January 24, 1945

Mr. C. K. Leith
Wardman Park Hotel
Washington 8, D. C.

Post War Zinc Policy

Dear Mr. Leith:

Referring to your letters of October 12 and December 30, I have spent considerable time endeavoring to correlate data and crystallize opinions which might be of some value to you in the formulation of a post war policy for zinc.

As you are well aware, the problems of zinc cannot be separated from many others that will demand solution in the turbulent period ahead. How many will depend entirely on whether we use our power and prestige in a realistic manner or lose both by attempting to change human nature by agreements, charters, and edicts.

From my limited and prejudiced viewpoint far too many nations are now and will be wallowing in quicksand during the next ten years, in spite of anything we can do and our first objective should be to make sure we stay on solid ground for our own good and so that we shall be able to assist in the rescue of the others over the long period of time necessarily required to do so.

DOMESTIC ZINC SUPPLY

With the above in mind I approach your first question---"What specific post war steps should be taken by our Government to assure the United States of adequate foreign supplies of zinc."

With the exception of the periods of World War I and II this country has been self sufficient as to zinc during the 30 years I have been connected with the industry.

The data in Table I attached show that during the 15 year period 1925 thru 1939 the total zinc imported was the equivalent of only 3.46% of the slab zinc produced in the United States and that over 60% of the imports entered this country in the form of ore and concentrates for treatment.

Table III shows the Mine Production of Zinc in the United States by districts for the five years 1939 thru 1943, and the estimated production for 1944. Nineteen hundred and forty-three production was

160,389 tons greater than that for 1939, equivalent to an increase of 27.46%; 95.36% of this increase, 152,951 tons, came from the Western Region for which the 1943 production was 90.34% greater that for 1939. Further loss of miners in 1944 accounts for the lower production last year.

During the ten year period preceding the outbreak of World War II, the average domestic price of zinc was more than one cent per pound below the average cost of production, and the normal development of the industry was not carried. Since March 1942 the Rocky Mountain industry has suffered from an acute shortage of miners. When these facts are considered, the 90% increase in Western production in four years is strong evidence that it can be further expanded.

At the four properties, on which I have detailed data, production could now be increased by at least one-fourth with a reduction of approximately 15% in unit costs if adequate labor were available. I believe a similar condition generally exists at other properties in this region.

The question arises as to whether or not Rocky Mountain production can be expanded sufficiently to offset a probable loss ranging from 75,000 to 100,000 tons of zinc annually in the Tri-State District. I am of the opinion it can, when and if demand (price) warrants and "risk" capital is invited back to work by the establishment of a constructive system of taxation.

Lack of a reason for exploration during the long "red" thirties, and lack of adequate manpower with which to do development since the outbreak of the war coupled with the general overload management has had in continuing adjustments to meet war conditions have combined to reduce constructive thinking in the industry, and one attempting to forecast the future might occasionally confuse "worked out managements" with "worked out mines."

Most good base metal mines have been granted many extensions on their original "life expectancies" by Lady Luck, metallurgists, engineers, equipment manufacturers, geologists, road builders and others. Good roads have been built across large undeveloped mineral areas in the west, since "risk capital" was driven from our industry.

I have no first hand information on the Eastern region, but data available indicate, 175,000 to 200,000 tons of zinc annually can be produced in the Eastern States at prices substantially below those of the other districts.

Summarizing, I estimate that the nation can maintain a production of 600,000 to 700,000 tons of domestic zinc annually at prices our economy can well afford to pay, taking into consideration the relative

value of the domestic market created by a healthy home industry and the value of the additional foreign trade that results from zinc imports.

I sincerely hope that post war business activity in the United States will create a demand for zinc in excess of the productive capacity of domestic mines.

FOREIGN ZINC SUPPLY

During 1929 with the average price of zinc 5.4¢ per pound in London, the foreign zinc industry rpoduced approximately 989,000 short tons, a record up to that time. In 1938 foreign production totaled 1,274,000 tons for a new record high, with the average London price at 3.05 cents. The increase of 28.8% in production in spite of an apparent average price decrease of 43.5% certainly indicates an adequate supply, after discounting the drive for self sufficiency in the Axis nations that existed at the time.

The "Metal Bulletin" London, estimates worl zinc smelter output for 1942 at 1,947,000 metric tons and for 1943 1,965,100 metric tons. On the basis of these figures it appears the total production of slab zinc from materials of foreign origin is now at the rate of approximately 1,500,000 short tons per annum.

I have no data at this time on which to hazard an estimate as to the probable post war foreign consumption of zinc with, (I hope) the demand for war materials at a minimum, but an offhand opinion is that the foreign zinc industry will have production capacity considerably in excess of foreign consumption and one that can be further expanded.

Probable post war demand for dollar exchange to stabilize debt will in my opinion create a enormous pressure to market foreign metals in the United States at prices below domestic cost of production.

In other words, I have no fear that any possible combination of nations could or will desire to prevent our obtaining adequate foreign zinc to meet any deficiency we may have, during the long period of time that will be required to raise the standard of living outside the United States to a point at which foreign consumption will exceed foreign capacity to produce.

FOREIGN TRADE

Many men in high places today offer as the solution for the nation's post war economic problems the expansion of annual exports of manufactured goods to at least 7 billion (and some as high as 11 billion dollars) in order to sustain a post war national income of

140 billion to 150 billion dollars. The plans necessarily propose to balance exports with imports. Public statements as to what items are to make up these imports are limited generally to our natural imports, (goods we do not produce) and raw materials, with nonferrous metals, cattle, wool, and sugar given prominent mention. I am in agreement with these proposals on one thing, and that is that a national income of 150 billion dollars can be sustained in the United States, and that employment can be provided for all who are able and willing to work.

Judging from the past, I think our first job is to insure a high rate of production in the United States. (This cannot be done by destroying the raw material producers of the west who consume approximately 20% of the nation's goods). A prosperous United States will result in our using 4.5% to 5.0% of our income for the purchase of natural imports, foreign luxury goods, and export capital, and ultimately provide dollar exchange for a large export trade.

In tossing around the large figure given above for our national income, I am assuming a price level that will support the present wages in our basic industries. Altho wages have been unreasonably high and efficiency generally low in war construction and government operations, I consider the present wages, exclusive of overtime abuses, in our basic raw material industries, are reasonable and should be maintained if we are to manage a 300 billion dollar debt burden. I do not favor destroying the purchasing power of our miners in an attempt to compete with foreign metal produced with labor paid from one-tenth to one-fourth as much.

The proposal to leave our nonferrous metals in the ground for future emergencies, and buy foreign labor in the form of metal is unsound for the following reasons:

(1) Mine workings in Western underground mines cave or fill up within a short time if not maintained, and reopening a mine that has been down several years is an expensive uncertain job.

(2) A substantial portion of available ore reserves would be lost, along with highly skilled organizations.

(3) The mines could not be reopened in a reasonable length of time and would therefore be of little value during an emergency.

(4) Development of new areas would stop.

(5) Approximately one-half the population of the Rocky Mountain states would be forced to move into other areas or live on the taxpayers. Importing labor does not cure unemployment.

(6) The manufacturers of finished goods who hope to expand foreign trade by such a procedure, or those who think they would increase their profits thru obtaining lower price raw materials would lose domestic business for their goods of a value far in excess of any gain from exports or the temporary theoretical profit from lower cost raw materials.

Before going off the deep end on such a proposal, a study of the economic troubles of Europe should be made to determine what happens to countries whose economies have no raw material base.

From my prejudiced point of view, increased production is the answer to our own and the world's economic ills. Production necessarily starts with raw materials and capital, and raw materials or any other kind of products or service cannot be furnished for long at prices below the cost of production without destroying capital.

Unfortunately far too many of our manufacturing and distributing industries (most of whom owe their present power to tariff protection during their early development) have their profits normally controlled primarilly by the volume of the business they do. As they are now so well anchored in the control of outlet channels in this country, it is not strange that some of them would forget the importance of their home base and seek further volume in far fields, especially after the ten years of bad going immediately preceding the outbreak of World War II.

Added to the pressure of this group for foreign trade are also the foreign producers who look to our markets, the shipping interests, and those who believe the entire structure should be torn down and built over to eliminate the necessity of repairing some of the plumbing, and to get rid of a tenant on the 42nd floor who pays his rent but criticizes the service.

The general problem is also confused by those who believe raising wages should not raise prices, and consumers who endeavor to forget they are also producers when discussing the cost of the merchandise they buy.

Human nature being what it is, the fisherman who goes to his favorite trout stream on the opening day of the season when the water is too muddy for fly fishing, generally travels many miles across one divide after another with the hopes of finding clear water and finally goes home with an empty basket altho the sports page of his newspaper told him before he left home that all the streams were high and muddy. Some of the planners picturing the great benefits that would accrue from a large foreign trade if realized in my opinion are like the fisherman in that they don't want to be bothered too much with facts.

The fisherman should change to bait, fight the brush and get a mess of fish the hard way on the stream he knows. This procedure in any event would insure the saving of time, tires, and gasoline and avoid the hazard of a trespass suit incident to traveling in unknown territory.

In spite of my comments above, I recognize so called natural foreign trade as the only means by which we can obtain goods required by our economy that we do not produce or do not produce in sufficient quantities; also that in order to pay for these materials we should sell to other nations our products that they need and which they cannot produce and for which they can pay.

Exports forced into a foreign country by monopolies or the pressure of credit to the detriment of the producers of that country make enemies instead of friends. The restriction of natural trade between other countries by the control of exchange, shipping or monopoly of any kind should not be practiced by ourselves or left uncontested when practiced by others, except by International agreement to curb the activities of those who violate agreements or break International laws.

FOREIGN CREDITS

In my opinion there are too many individuals in this country today willing and anxious to greatly expand foreign credits with the idea of opening markets for their goods, not considering that doing so may cost us not only our money, but our friends and wreck our own credit structure.

Sound short term credits required to move goods can be conveniently made thru our Export-Import bank, but extensions of unsound credits to be used for anything the borrowers see fit, such as were given after World War I, should not be permitted. I am not sufficiently informed to pass an opinion on the merits of the agreement drawn at Bretton Woods.

A portion of our post war balances under lend-lease should be liberally used if possible to obtain bases and airfield rights needed for our security, and the repayment of the remainder deferred indefinitely to the period of the next war in which we are involved. We should also provide and write off as part of the cost of the war a substantial amount for rehabilitation of the war torn nations so that they will be able to go back to work. This should be treated as a controlled donation not requiring repayment, but contingent upon a peace settlement of our liking. We can gain more in the long

run by playing the role of Santa Claus than that of Uncle Shylock, when the chances are slim that we would be repaid in any event, and when failure to help other nations at the end of the war insures a disorderly world over a long period of time.

As stated above weakening our entire credit structure by dilution with unsound foreign credits should not be permitted. Neither should we fall for schemes that in the final analysis amount to the same thing.

Money for producers goods other than that contemplated for rehabilitation discussed above should be limited to "risk capital" of the common stock variety and furnished by experienced industries. Our State Department should encourage and assist American private capital in the establishment of manufacturing plants in foreign democracies, but should not attempt to obtain for this capital Special privileges or rights better than those available to the citizens of the respective countries either now or in the furture. On the other hand these rights should be no worse than those accorded other foreigners, and should be further protected by treaty to provide that the existing laws as to foreigners will not be altered adversely for the purpose of further discrimination against our nationals. However, the hazard incident to government policies relating to industry generally, such as those governing labor and taxes, is one any prospective investor should assume in any country he enters. When the policies get too harsh for private enterprise the nation runs out of private employers. Our State Department should continue to work hard to obtain rights for our nationals in foreign countries equivalent to those enjoyed by foreigners in this country. As success in this coupled with the post war advantages that will accrue from plane travel should result in a substantial increase in American investments abroad and a rich stream of tourists' dollars, it would also contribute to our export business and raise production abroad. The freezing or rigid restriction of exchange in peace times by foreign countries is another evil that should be eliminated by treaty guarantees before American capital should be allowed to enter. Many of our corporations have fresh in mind how exchange restrictions cost them their foreign investments.

AMERICAN ZINC INDUSTRY ABROAD

The opinions expressed above would generally apply to our zinc producers abroad. Their present property and operating rights should be protected, and an attempt also made to protect them against confiscation indirectly thru taxes or labor abuses, after we have solved this problem at home.

As stated above, however, we must not encroach on the sovereign powers of our neighbors or complain too much if we don't like their

systems of government. We should retain the option of not doing business with them. This brings me to so called reciprocal trade treaties and tariffs.

TARIFFS

The tariff on zinc was reduced from 1.75 cents per pound to 1.4 cents per pound by the Canadian agreement completed in December, 1938. During 1939 Canada exported to the United States 1,613 tons of zinc on which the duty reduction amounted to $11,291.00. The most favored nation clause in said treaty, however, resulted in the domestic price of zinc being reduced by $7.00 per ton to the equivalent of the foreign price plus duty, altho at the time the St. Louis price was approximately $18.00 per ton below the average cost of domestic production. Stating this another way, the American zinc producers were forced to donate to the manufacturers and distributors of zinc products $7.00 per ton, on the entire production for the first eight months of 1939 equivalent to $2,250,000.00. Donations were stopped by the outbreak of the European war. I fail to mention the ultimate consumers of the finished products containing zinc, as beneficiaries because under the present system of pricing, I do not believe they received the price of one beer each from the reduction in the price of zinc. The extra cost to the farmer of a one cent per pound increase in the price of zinc is reflected in only a 50 cent increase in the cost of roofing his barn with galvanized sheets. The same increase in the price of metal would represent less than one cent increase in the selling price of a galvanized pail.

The zinc smelting industry was also forced to make an additional contribution to manufacturers and distributors due to the duty reduction on Cadmium.

The quantity of imports (88% of which came from countries other than Canada) during the eight months prior to the outbreak of the war was comparatively small, so that by no stretch of the imagination could one justify the great injury to the domestic zinc industry on the basis of the promotion of foreign trade.

The zinc tariff that was reduced by the Canadian agreement was established by the Act of 1922, and not the much-criticized Smoot-Hawley Act of 1930.

During 1939 members of the industry furnished the Tariff Commission with complete detailed data and appeared at a hearing that was granted them. The results were negative as far as tariff relief was concerned. At the time of the hearing, we had assumed the Tariff Commission was a non-partisan organization whose actions were to be

controlled by facts. Members of the Commission asked few pertinent questions to indicate interest other than to dispose of us.

The trade agreement with Canada provides that should other foreign countries obtain the major benefit of any concession and if in consequence imports increase to such an extent as to threaten serious injury to domestic producers, both parties to the agreement reserve the right to modify or withdraw the concession. Altho this escape clause was much publicized as a safety factor, the failure to invoke it in the case of zinc tends to confirm other evidence that the Tariff Commission was used primarily to compile data to fit the free trade theories of Secretary Hull.

The power of the State Department to juggle the fates of long established essential industries by tariff adjustments, should be reduced, by amending the Act of Congress before further extension to provide:

(1) That proposed (negotiated) duty reductions shall be made public at least six months prior to the signing of treaties.

(2) That at any time during said six months period they shall be subject to veto on the request of one-third the members of the Senate, and

(3) Escape clauses such as the one in the Canadian agreement shall be invoked any time during the life of the treaty upon the request of one-third the members of the Senate.

I do not believe such amendments would materially reduce the effectiveness of the State Department in negotiating trade agreements or bring back the evils incident to the old fashioned way of making tariffs.

Administrative agencies of government generally are in disrepute at this time due to trying to accomplish too much in too short a time, and the fact that a few of the men in these agencies are drunk with power and do not want to be bothered with answering questions that would result from keeping the public informed on matters that vitally affect the nation's welfare. Fear of government is one of the greatest destructive forces on the loose today and must be eliminated if private industry is going to furnish 60,000,000 post war jobs. This cannot be done until government again deals in the open. The State Department's job will be a tough one during the next ten years in any event, and to obtain the public support that it should have to protect the nation's interests, it must not conceal its purposes from the American people.

Trade agreements of the type I have discussed above may be inadequate to deal with the conditions with which we may have to contend in the post war period, especially if we have to deal with various types of cartels established by or with the backing of governments, and straight government monopolies.

Europe with its concentration of population and an entirely inadequate supply of raw materials must obtain markets for manufactured goods to pay for raw materials, move a portion of its people or suffer with a low standard of living and the political ills that go with it. The raw materials producing nations will be poor markets for manufactured goods if prices for raw materials are not kept above the cost of production. If we must give Europe a portion of our domestic business, why not open our markets for a reasonable quantity of manufactured goods, especially in those lines in which monopolies, price fixing, and close control of distribution channels result in either low efficiency or high profits.

Anti trust suits are not only "messy", but when improperly instituted break down confidence in government, and in the long run are entirely ineffective. Attacking business just because it is big does not promote the nation's welfare. On the other hand some real price competition from foreign sources would be beneficial in those lines where fixed prices and long margins prevail.

Altho I have some ideas on unreasonable costs for unnecessary services, and methods of pricing finished goods, my viewpoint may be the same as on strong drink: "It is not good for the other fellow".

On the other hand, tariffs that were originally equitable or too high are now too low due to increased costs resulting from our government's labor policies. This is true in the case of zinc. As stated previously, I do not believe the nation's interests would be served by attempting to reduce wages in our basic industries, as doing so will result in a conflict between management and labor that we cannot afford, and in addition reduce the purchasing and tax paying powers of a large group at a time we need both to balance our economy. The increases in wages in this country have destroyed tariff protection as far as those industries are concerned in which labor costs of production represent more than one-half selling prices.

The probable depreciation after the war of foreign currencies in terms of the dollar, may also result in increasing further the disparity between domestic and foreign costs for production of basic raw materials.

Combined Metals Reduction Company

Sheet 11 Date 1/24/45 To Mr. C. K. Leith

The following tabulation shows estimated average increases over 1939 in the costs of mining and milling of zinc and lead ores in the Rocky Mountain region based on 1944 wages, 1939 labor supply and efficiency, and 1939 production of 86 mines and 31 mills, in this area:

	Lead Plus Zinc	Lead	Zinc
Production	291,453 tons	164,991	126,463

	Increase in Costs	Per Ton Lead	Per Ton Zinc	Per Ton General
Mine & Mill Labor 1,927,487 Man Shifts @ $3.48	$6,707,654	$23.01	$23.01	$23.01
*Lead Smelting Charges	1,337,432	8.11		4.59
*Zinc Smelting Charges	2,589,312		20.47	8.89
Railroad Transportation	486,507	1.17	2.33	1.67
Mine & Mill Supplies (5%)	200,000	0.68	0.68	0.68
General Overhead (10%)	200,000	0.68	0.68	0.68
Total Increase	$11,520,905	$33.65	$47.17	$39.52

Man shifts per ton of lead plus zinc for mining and milling are estimated at 6.6134, exclusive of transportation and smelting.

* Includes metal recovered and not paid for.

From Table VII attached, the estimated average loss on mining and milling lead zinc ores in 1939 in the Rocky Mountain area after depreciation and depletion, but exclusive of interest and federal taxes was $15.46 per ton of metal, distributed $12.78 per ton of lead and $18.95 per ton of zinc recovered, using 5.05 cents per pound as the price of lead at New York and 5.12 cents per pound as the price of zinc at St. Louis.

With 1939 production and labor efficiency and 1944 wages, I estimate break even prices on lead and zinc as follows:

	Lead Per Ton	Zinc Per Ton
1939 Loss	$12.78	$18.95
1939 Price per ton	101.00	102.40
Increase in Costs	33.65	47.17
Estimated Average Break even Prices before interest and income taxes	$147.43	$168.52
Prices per pound	7.37¢	8.42¢

Assuming ten per cent before taxes as a fair return on the captial used, exclusive of ground costs and exploration for an industry as hazardous as mining of lead and zinc. I estimate the post war prices for these metals, with gold and silver at present prices, wages at the 1944 level, and labor supply, efficiency, and production the same as for 1939, should be 8.06 cents per pound for lead at New York and 9.11 cents for zinc at St. Louis to insure a healthy self perpetuating lead-zinc industry in the Rocky Mountains.

The present prices including premium metal payments for the Western region are estimated from Tables IV and VI at approximately 7.60 cents per pound for lead and 10.55 cents per pound for zinc which have been carefully determined to give the industry as a whole a break even after the cost of depletion and depreciation but before taxes for the production of 300,000 to 325,000 tons of zinc and 200,000 to 225,000 tons of lead from the Rocky Mountain area under present adverse conditions. It should be noted, zinc production in the Rocky Mountain region in 1944 exceeds lead production in the ratio of 3 zinc to 2 lead as compared to a ratio of 8 zinc to 10 lead in 1939. Heavy subsidies for zinc production as compared to lead are responsible for the change in ratio. No accurate data are available to me at this time as to the average metal contents of the lead and zinc ores produced in the Rocky Mountains last year, but considerable production is being had from zinc ores containing very low gold, silver and lead values.

The Quota Committee should be able to give you complete information on present costs and production in the industry.

Altho my data are not from Treasury records, I believe they are conservative and accurate enough to show conclusively that a duty of 1.75 cents per pound on zinc would be entirely inadequate to protect a healthy lead-zinc industry in the Rocky Mountain area with present wages, in the event Europe fails to put her house in order or for any reason is unable to purchase the raw materials she needs at prices above the costs of foreign production, and as a result raw materials pile up seeking markets.

To avoid the destruction of the domestic industry either by foreign imports or by forcing domestic prices below the average cost of production to avoid imports, I propose for analysis the following proposal for determining the duties on metals:

(1) "Cost of Production" prices for domestic mining industry shall be arrived at on the basis of the existing average cost for mine labor, and variations determined for increases or decreases in mine labor costs, including all forms of insurance and payroll taxes.

(2) The cost of production shall include depreciation and depletion on the present basis as allowed for tax purposes.

(3) In dealing with lead and zinc the net mine recoverable value of gold and silver shall be credited to the cost of production of the base metals in the proportion in which they have been produced during the past twenty years of (Bureau of Mines data) in lead and zinc ores.

(4) The import duty for any foreign metal shall be the difference between the bonafide London price (average for week preceding date of receipt at port of entry) in terms of dollars and the adjusted domestic "cost of production" established price plus a differential to be determined in each case; for example, one-half cent per pound in the case of zinc for profit.

(5) The "cost of production" price shall be adjusted annually in conformity with a formula set up by Congress using Bureau of Mines production data and Department of Labor statistics.

(6) An administrative agency, such as Metals Reserve, shall be authorized to purchase annually from foreign sources at foreign prices for emergency stockpile an amount equivalent to "X" quantity to be determined for each metal on the basis of average annual imports for domestic use for the past 20 years, (1925-1944), also to purchase at any time for emergency use only, foreign metal in quantities equivalent to the dollar value of all duties collected on said metal.

The 20 year control period 1925-1944 inclusive is used in paragraphs (3) and (6) above, as in my opinion it included all the variations the industry is likely to face in the future.

The advantages of the proposal as I see them from the viewpoint of a miner of lead and zinc are:

(1) It protects the domestic industry against price deflation due to distress foreign metal, but not against that resulting from overproduction in this country.

(2) Provides a means for assisting in the maintenance of world prices, and production.

(3) Does not leave the fate of the domestic industry in the hands of an administrative agency of government.

(4) Will permit long range planning in the industry.

(5) Provides for the accumulation of emergency stockpiles of metal.

(6) Will tend to cut down the violent fluctuations in metal prices and the havoc in the industry incident thereto.

(7) Protects consumers against price squeezes.

(8) Gives the Western miner reasonable assurance that he will not have to forfeit his job to foreign workmen, abandon his home and move to other sections of the country in an attempt to find employment, take up a subsistence homestead or a rake and live on the taxpayers.

As to foreign imports to be purchased by the agency, these should be preferably in the form of ores and concentrates and processed to metal for storage as domestic plant capacities are available. This is in line with my theory that we should save ourselves first.

Before leaving the subject of tariffs I wish to deal briefly with the proposals contemplating the assignment of so called import quotas for metals, under which estimated quantities required to fill alleged deficiencies would enter our markets duty free.

As outlined above, I have no objection to zinc coming into our market duty free when the domestic price of zinc is above the "Cost of Production" price plus a differential for profit sufficient to perpetuate the domestic industry, but am strongly opposed to importing a fixed quantity of zinc or a percentage of either our domestic production or consumption during any period the domestic demand for zinc makes a price below the cost of domestic production, for the reason that in so doing, we would be destroying domestic production and importing labor in the form of metal at a time of unemployment in the domestic industry.

Unfortunately a surplus of from five to ten per cent of a raw material frequently results in forcing prices below the cost of production for a substantial portion of the industry. In the case of the metals, price reductions seldom increase consumption, but generally cause consumers to skimp inventories. This results in further increase in surplus stocks while the industry is adjusting production the hard way. During such periods, the nation's welfare is not served by the real importation or a potential importation of the metal.

Under conditions such as existed in the zinc industry during the first six months of 1939, when the price of zinc was approximately 4.5 cents per pound at St. Louis, and the estimated average cost of production for the Rocky Mountain mining and milling portion of the industry was 6.06 cents, including:

Fixed Overhead	0.310¢ per lb.
Depreciation	0.375¢ " "
Depletion	0.542¢ " "
	1.227¢ per lb.

practically one-half of the Western industry was sustaining not only the loss of overhead, depreciation and depletion costs but in some cases a direct operating loss in addition to their ore.

Accepting a 100,000 ton quota of foreign metal under such conditions in my opinion would have forced abandonment of many of the higher cost mines, and resulted in the loss of large quantities of mineralized rock, that have been vital to the nation's war effort during the past four years.

Under more favorable conditions with market prices above average straight operating costs with demand less than available mine capacity, I estimate the importation of zinc metal to replace production in the Rocky Mountain area would result in losses as follows, based on 1939 metal prices and 1939 production ratios of gold, silver, lead and zinc and on the assumption the production of the crude ore containing the zinc would have the average analysis of the 1939 production:

	Per Ton of Zinc
Loss in direct production of new wealth in form of gold, silver, lead, zinc and copper	$294.25

Combined Metals Reduction Company

Sheet 16 Date 1/24/45 To Mr. C. K. Leith

Loss in Employment Rocky Mountain Area:	Per Ton Zinc
Mining & Milling	14.64 man shifts
Smelting Lead and Iron Conc.	1.94 " "
Zinc Reduction	2.20 " "
Total Direct Labor	18.78 Man shifts

Direct labor shown above does not include transportation and that required for mining coal, fluxes, etc.

On the assumption imports would be in the form of concentrates the total direct man shifts lost would be 16.58 per ton of zinc.

Mr. Roland A. Vandegrift and associates made a survey covering "The Economic Dependence of the Population of Utah" completed in May, 1931. He shows:

(a) 47.17% of the population of Utah in 1930 dependent on the nonferrous metal industry.

(b) 2-1/3 service wage earners dependent on each man employed in the primary industry.

(c) 3.552 dependents, including the worker, for each wage earner.

Applying Mr. Vandegrift's factors for the year 1930, 16.58 man shifts in the primary industry would furnish 38.68 man shifts of employment for service population including state government and utilities. Therefore, total employment per ton of zinc produced would be 55.26 man shifts, representing support for one day of 196 dependents including the workers.

The cost of unemployment payments including administration for the primary workers pushed out of jobs estimated at $5.00 per man shift, would be $82.90, equivalent to 4.2 cents per pound of zinc, with the 55 wage earners affected standing a reduction of approximately 27% in income based on $5.50 (1939) miners wages and $20 per week for unemployment payments. In other words the importation of 100,000 tons of zinc per year to displace Rocky Mountain production, except during periods in which demand exceeds domestic production, would make necessary the uprooting of 65,000 people,* a loss to government of 8 million dollars per year for payments of unemployment insurance, and a probable loss in tax revenue of at least 30% of the gross wealth not produced. Using 1939 values, this loss in tax revenue would be equivalent to $8,800,000 on 100,000 tons of zinc imported.

*Note: 196 people are supported one day by the production of one ton of zinc in the Intermountain region. 100,000 tons (annual proposed imports), times 196 divided by 300 days equals 65,333, the number of people that would be left without support due to importation of the 100,000 tons zinc to displace western production. This does not take into account the loss of employment in other areas due to loss of western market.

Such an import subsidy of roughly 8.5 cents per pound of zinc is not recommended.

CARTELS

From my viewpoint on zinc, you can readily understand that I favor foreign cartels to maintain orderly production in sound raw material industries to prevent prices being forced below the cost of production, but believe such cartels should be regulated or participated in by the respective governments involved to prevent curtailment of production during periods prices are above the average cost of production. A reasonable price includes a profit commensurate with the money invested multiplied by the hazard factor, and in the case of most metals in my opinion should be approximately 20% annually before taxes on the money used. Successful mining enterprises expand both knowledge and production and money invested in them must not be treated without considering the hazards they have overcome to become successful.

At long range, it appears prosperous raw material industries throughout the world are necessary to support the peoples of Europe dependent upon trade, manufacturing, tourists, and the rental of money.

STOCKPILING

I am in general agreement with the steps taken to store for emergency use only, government owned metal and strategic minerals or any other material that will stand long storage that we do not produce or cannot produce in sufficient quantities to meet war needs.

One other matter in connection with stockpiling which I approach "with my powder dry" is that warehouse receipts representing virgin metal in government owned stockpiles should be the basis of non-interest bearing federal notes to be used to retire government bonds, using weighted average metal prices for the period 1925-1944 inclusive as sound values. This would relieve the taxpayer of any interest load in connection with stockpiling and provide better currency than the credit currency that it would replace.

Combined Metals Reduction Company

Sheet 18 Date 1/24/45 To Mr. C. K. Leith

If domestic nonferrous metals had been purchased by government during the early thirties there is no question but what our war needs could have been satisfied as to lead, zinc and copper from domestic supplies at an enormous saving in the cost of the metal as well as in the relief load that resulted from shutdown mines.

Proposals of this nature were turned down because they had no political appeal at the time.

Assuming 600,000 tons of slab zinc as our average annual capacity, we could have obtained in the nine year period between 1931 and 1939 inclusive a stock of 1,700,000 tons in excess of the consumption entirely from domestic sources and would have had a healthy industry going into the war instead of a sick one.

I regret shortage of time has made it necessary for me to burden you with such a long discourse. I am attaching summaries of the various tables and estimates that serve as a basis for the data given above, and shall be pleased to answer any questions you may have in connection therewith.

Sincerely yours,

Edward H. Snyder

EHS: m

TABLE I

SLAB ZINC PRODUCED UNITED STATES

INCLUDING SECONDARY AND FOREIGN ORES

Year	Tons	All Grades Price Per lb.	Gross Value	IMPORTS From Ores & Concts. Tons Metal	IMPORTS Slabs	IMPORTS Total
1925	612,127	7.64	$93,043,000	17,315	24	17,339
1926	659,221	7.50	98,883,000	6,431	22	6,453
1927	635,300	6.41	81,439,000	15,566	579	16,145
1928	651,247	6.10	79,452,000	11,056	3	11,059
1929	671,868	6.60	88,687,000	13,311	226	13,537
Totals	3,229,763	34.25	$441,504,000	63,679	854	64,543
Av.	645,953	6.85	88,300,800	12,736	171	12,909
1930	532,894	4.70	51,158,000	8,684	347	9,031
1931	313,621	3.80	23,825,000	780	275	1,055
1932	221,866	3.00	13,312,000	1,904	310	2,214
1933	337,269	4.20	28,331,000	2,133	1,890	4,023
1934	383,281	4.30	32,962,000	14,277	1,725	16,002
1935	449,284	4.40	39,537,000	10,520	4,444	14,964
1936	534,341	5.00	53,434,000	170	11,660	11,830
1937	608,458	6.50	79,100,000	8,811	39,369	48,180
1938	477,954	4.80	45,884,000	18,584	7,486	26,070
1939	557,664	5.20	57,977,000	*36,099	30,898	66,997
Totals	4,416,632	45.90	$425,540,000	101,962	98,404	200,366
Av.	441,663	4.59	42,554,000	10,196	9,840	20,037

*NOTE: Canadian Imports to U. S. 1939 -- 1,613 tons.

ESTIMATE

Dec. 30/44
E. H. Snyder

TABLE II
MINE PRODUCTION OF LEAD IN UNITED STATES
(BUREAU OF MINES)
Short Tons

	Western	Central	Eastern	Total	Average Price Per Pound
1939	209,214	198,481	6,284	413,979	4.70
1940	244,974	207,587	4,831	457,392	5.00
1941	246,551	209,362	5,513	461,426	5.70
1942	256,535	235,229	4,475	496,239	6.70
1943	231,410	217,060	4,843	453,313	7.63
1944*	206,000	196,000	6,000	408,000	7.94

* Estimated average price includes premium metal payments.

TABLE III
MINE PRODUCTION OF ZINC IN UNITED STATES
(BUREAU OF MINES)

	Western	Central	Eastern	Total	Average Price Per Pound
1939	169,305	221,846	192,656	583,807	5.12
1940	241,277	244,976	178,815	665,068	6.30
1941	281,809	276,006	191,310	749,125	7.50
1942	306,443	256,352	197,415	760,210	9.30
1943	322,256	222,707	199,233	744,196	10.48
1944*	315,200	217,000	177,000	709,200	10.89

(See Attached)

* Estimated average price includes premium metal payments.

TABLE IV
PERCENT TOTAL MINE PRODUCTION OF ZINC
BY DISTRICTS

	Western	Central	Eastern	Total
1939	29.00	38.00	33.00	100.00
1940	36.27	36.83	26.90	100.00
1941	37.62	36.84	25.54	100.00
1942	40.31	33.72	25.97	100.00
1943	43.10	32.90	24.00	100.00
1944	44.44	30.60	24.96	100.00

Western Zinc production was 152,951 tons greater in 1943 than in 1939, the increase being equivalent to 90.34% of the 1939 Western production and 95.36% of the difference between 1939 and 1943 for the entire United States.

TABLE V
AVERAGE PRICES PER LB. OF LEAD AND ZINC
FOR 1943 AND PERIOD JANUARY 1, TO SEPTEMBER 1, 1944

	1943		1944 8 Mos.	
	Lead	Zinc	Lead	Zinc
Tri State	9.612¢	12.542¢	9.668¢	12.976¢
Balance of U. S.	7.462	9.725	7.605	10.095
Total U. S.	7.627	10.484	7.936	10.886

Eastern mines received 8.87¢ per lb. for zinc and Western mines 10.55 during the last quarter of 1943. 1944 data not available.

TABLE VI
AVERAGE PRICE PAID PER POUND
BY DISTRICTS AND BY MINES IN EACH QUOTA GROUP
LAST QUARTER 1943

	Total Production of Recoverable Zinc (tons)**	Per cent of Total Production*	Total Amount Paid Dollars	Average Price Paid Per lb. of Zinc--Cents
EASTERN STATES:				
A Quota Mines	53,100	94.6	9,063,835	08.53
B Quota Mines	1,110	2.0	294,250	13.25
C Quota Mines	1,902	3.4	596,750	15.69
Total	56,112	100.0	9,954,835	08.87

TABLE VI CONT.

	Total Production of Recoverable Zinc (tons)**	Per cent of Total Production*	Total Amount Paid Dollars	Average Price Paid Per lb. of Zinc--Cents
WESTERN STATES:				
A Quota Mines	70,904	83.7	13,932,545	09.83
B Quota Mines	6,780	8.0	1,754,225	12.94
C Quota Mines	7,039	8.3	2,181,135	15.49
Total	84,723	100.0	17,867,905	10.54
TRI-STATE:				
A Quota Mines	16,596	31.8	3,381,730	10.19
B Quota Mines	16,745	32.1	4,356,440	13.00
C Quota Mines	18,828	36.1	5,905,680	15.68
Total	52,169	100.0	13,643,850	13.08
TOTAL U. S.:				
A Quota Mines	140,600	63.7	26,378,110	09.38
B Quota Mines	24,635	15.4	6,404,915	13.00
C Quota Mines	27,769	20.9	8,683,565	15.64
Total	193,004	100.0	41,466,590	10.74

**From data compiled by Ores and Concentrates Section, Zinc Division, W.P.B. Based upon monthly figures as reported by the Bureau of Mines for Eastern and Western States and by McColgin of the Metals Reserve Company for the Tri-State District. These figures differ slightly from the data reported in the U. S. Bureau of Mines annual survey of mine production.

*Estimated on the basis of assigned quotas and over-quota production.

TABLE VII
ESTIMATED LOSS ON THE MINING & MILLING OF LEAD & ZINC ORES
IN THE ROCKY MOUNTAIN AREA
BASED ON 86 MINES - 31 MILLS
FOR THE YEAR 1939

PRODUCTION - Ore & Concentrates

Crude Ore Mined	2,739,957 tons	Including 182,570 tons direct smelting
Ore & Tailings Milled	2,796,971 "	
Lead Concentrates Produced	269,192 "	
Iron Concentrates Produced	111,485 "	
Zinc Concentrates Produced	259,039 "	

Estimated Assay Ore Milled: .03 ozs. Gold, 5.53 ozs. Silver, 6.38% Lead, 6.05% Zinc and 0.21% Copper.

Recoverable Metal				Gross Value
Gold	59,938.47 ozs.	@	$35.00	$2,097,846
Silver	11,237,207 "	@	$.70625	7,936,276
Copper	5,705 tons	@	$240.00	136,920
Lead	164,990 "	@	$101.00	16,663,990
Zinc	126,463 "	@	$102.40	12,949,811
	Total Gross Value			$39,784,843

Expense - Applicable to both Lead and Zinc				Cost Per Ton Lead Plus Zinc
Mining & Milling		$25,212,145	$25,212,145	$86.505
Freight				
Crude Ore Custom	750,393 tons	1,688,384		
Crude Ore Other	300,000 "	180,000		
Iron Concentrates	111,485 "	8,919		
Copper Bullion	5,091 "	70,001	1,947,304	6.681
Smelting & Refining				
Silver Recovered & Not Paid For	337,000 ozs.	238,088		
Gold Recovered & Not Paid For	5,395 "	189,000		
Iron Concentrates	111,485 tons @ $3.50	390,198		
Copper	5,091 tons @ $150.00	763,650	1,580,936	5.424
Expense Chargeable to Both Lead & Zinc			$28,740,385	$98.610

TABLE VII

Sheet 2

Expense - Applicable to Lead Only					Cost Per Ton
Freight on Lead	164,991 tons	@ $13.75	$2,268,626		
Freight on Lead Conc.	269,192 "	@ .08	21,535		
Lead Conc. Smelting	269,192 "	@ 1.00	269,192		
Crude Ore Smelting	182,573 "	@ 6.00	1,095,438		
Lead Recovered but not paid for	19,433 "	@ 67.25	1,306,869		
Refining	164,990 "	@ 20.00	3,299,800	$8,261,460	$50.072

Expense - Applicable to Zinc Only					
Freight on Zinc	126,463 tons	@ $ 9.35	1,182,429		
Freight on Zinc Conc.	259,039 "	@ 3.82	990,800		
Smelting Zinc Conc.	259,039 "	@ 14.70	3,807,912		
Smelting Zinc not paid	14,052 "	@ 93.05	1,307,538	$7,288,679	$57.63

SUMMARY

Expense Distributable		Per Ton Metal	Per Ton Lead	Per Ton Zinc
Mining & Milling	$25,212,145	$86.505		
Freight	1,947,304	6.681		
Smelting & Refining	1,580,936	5.424		
	$28,740,385	$98.610	$98.610	$98.610
Expense Chargeable to Lead Only	8,261,460	28.346	50.072	
Expense Chargeable to Zinc Only	7,288,679	25.008		57.634
Total Expense	$44,290,524	$151.964	$148.682	$156.244
Credit Value Gold, Silver, Copper	10,171,042	34.898	34.898	34.898
Cost After Credit Gold, Silver, Copper	$34,119,482	$117.066	$113.784	$121.346
Value of Lead	$16,663,990		$101.000	
Loss per Ton Lead			$12.78	
Value of Zinc	$12,949,811			$102.400
Loss per Ton Zinc				$18.946
LOSS	$4,505,681	$15.46	$12.78	$18.95

ESTIMATE
GROSS VALUE LEAD-ZINC ORE
PRODUCED BY 86 MINES 31 MILLS
IN ROCKY MOUNTAIN AREA
1939

Dec. 28/44
E. H. Snyder

Recoverable Metal

Gold	59,938.47	ozs. @ $35.00	$2,097,846
Silver	11,237,206	" @ $.70625	7,936,276
Copper	5,705	tons @ $240.00	136,920
Lead	164,990	" @ $101.00	16,663,990
Zinc	126,463	" @ $102.40	12,949,811
	Total Gross Recoverable Value		$39,784,843

Expense

Railroad Freight	$6,445,707	
Smelting and Refining	12,667,685	
Mining and Milling	25,212,145	
Total Expense exclusive of Federal Taxes	$44,325,537	$44,325,537
Estimated Mine and Mill Loss		$ 4,540,694

Crude Ore Mined	2,739,957	tons
Ore and Tailings Milled	2,796,971	"
Lead Concentrates	269,192	"
Iron Concentrates	111,485	"
Zinc Concentrates	259,039	"
Direct Smelting Ore	182,570	"

Recoverable Lead plus Zinc per ton of ore 212.74 lbs. 10.637%

Man Shifts per ton Lead plus Zinc 6.6133 - Mining and Milling only.

Crude Ore per man shift 1.4215 tons - Mining and Milling only.

ESTIMATED TRANSPORTATION COSTS
1939 LEAD-ZINC INDUSTRY
86 MINES - 31 MILLS
ROCKY MOUNTAIN AREA

Jan. 2/45
E. H. Snyder

Ore and Concentrates	Tons	Rate	Total	
Custom Mills Lead Conc.	92,213	.08	7,377	
Custom Mills Zinc Conc.	99,249	4.67	463,493	
Custom Mills Iron Conc.	111,485	.08	8,919	
Other Mills Lead Conc.	176,979	.08	14,158	
Other Mills Zinc Conc.	159,790	3.30	527,307	
Crude Ore - Custom	750,393	2.25	1,688,384	
Crude Ore - Other	300,000	.60	180,000	
Total Freight on Ore & Conc.			$2,889,638	$2,889,638

Bullion and Metal Freight	Tons	Rate	Total	
Zinc	130,208	9.35	1,217,444	
Lead	164,991	13.75	2,268,626	
Copper	5,091	13.75	70,001	
Total Freight on Metal			$3,556,071	$3,556,071
Total Freight				$6,445,709

Smelting and Refining Charges

Direct Smelting Ore	182,573 tons @ $6.00		1,095,438
Lead Concentrate	269,192 " @ $1.00 base (60%)		269,192
Lead Not Paid (6,776 + 12,657) = 19,433 tons @ 67.25			1,306,869
Refining	164,990 tons @ $20.00		3,299,800
Silver Deductions	3% (337,000 ozs.)		238,088
Gold	5,395 ounces		189,000
Zinc	14,052 tons @ $93.05		1,307,538
Copper	5,091 " @ $150.00		763,650
Iron Concentrates	111,485 " @ $3.50		390,198
Zinc Conc.	259,039 tons @ $19.40	$5,025,356	
	Less Freight	1,217,444	3,807,912
Total Smelting and Refining			$12,667,685	12,667,685
Total Freight and Smelting				$19,113,394

Gross Value	$39,784,843
Total Freight and Smelting	19,113,394
Smelter Return Value on Ore & Conc. after Freight	$20,671,449

ROCKY MOUNTAIN INDUSTRY

ESTIMATE
CAPITAL INVESTED
AND
DEPRECIATION & DEPLETION FOR MINING & MILLING LEAD-ZINC ORE INDUSTRY
BASED ON 1939 - PRODUCTION OF
86 MINES AND 31 MILLS IN ROCKY MOUNTAIN REGION
(DOES NOT COVER COMPLETE INDUSTRY)

Dec. 28/44
E. H. Snyder

Crude Ore Mined		2,739,957 tons		
Crude Ore and Tailings Milled		2,796,971 "		
Estimated Mill Capacity		14,000 tons per day		
Installation Cost per daily ton capacity		$800		Per ton Ore
Estimated Investment - Mill Equip. & Bldgs.			$11,200,000	
Estimated Depreciation - Mill Equip. & Bldgs. @ 7%			784,000	0.29
Estimated Investment for Mine Equip. & Bldgs., Exclusive of development and cost of mining property per yearly ton crude ore production		*$5.00		
Estimated Yearly Mine Capacity - 86 Mines			4,000,000 tons	
Estimated Investment for Mine Equip. & Machinery			$20,000,000	
Estimated Investment Material & Supplies @ *70¢			1,900,000	
Estimated Investment Working Capital @ *$2.50			7,000,000	
Estimated Depreciation on Mine Equipment 7%			1,400,000	0.51
Estimated Depletion (Mine Value Custom Mill Ore		$4,635,363		
(Mill Value Concentrates		14,208,459		
15%		$18,843,822	2,800,000	1.02
Estimated Depletion on Direct Smelting Ore			360,000	
Total Depreciation	$2,184,000			
Total Depletion	3,160,000		$5,344,000	1.95
Total Investment Exclusive Cost of property and Exploration		$31,200,000		
Working Capital		8,900,000		
		$40,100,000		

NOTE: * Based on Data from 5 mines 3 mills.

ESTIMATE
INCREASE IN COSTS
PRODUCING LEAD AND ZINC
ROCKY MOUNTAIN AREA
BETWEEN 1939 — 1944

Wages	1939	Increase	1944
Miners Rate per shift	$5.50	$2.20	$7.70
Vacations	.11	.04	.15
Premium Shift Pay	.00	.25	.25
Overtime - 48 hour week	.00	.67	.67
Total Wages	$5.61	$3.16	$8.77
(Percent Increase in take home pay 56%)			
Industrial Insurance, Payroll Taxes	.56	.32	.88
Cost Per Man Shift	$6.17	$3.48	$9.65

Man Shifts Mining & Milling - 1939 - 86 Mines 31 Mills

		Man Shifts
Wage Earners	6,260	1,682,687
Plant Salaries	516	154,800
Central Office	300	90,000
Total	7,076	1,927,487

Crude Ore Production	2,739,957 tons
Lead Production	164,990 tons
Zinc Production	126,463 "
Total Metal	291,453 tons

Man Shifts per ton lead plus zinc 6.6134 for mining and milling

(Man Shifts per ton lead and zinc in Central States is estimated at 4.3 and in Eastern States 3.2)

Increase cost per ton lead and zinc for mine and mill labor 6.6134 x 3.48 = $23.01

Crude Ore Mined & Milled per Man Shift 1.4216

Increase in Lead Smelting Charges	Per Ton Ore & Conc. 1939	1944	Increase	Per Ton Metal
Base Lead Conc. & Direct Smelting Ore	$2.15	$3.82	$1.67	
Lead Concentrates 269,192 tons				
Direct Smelting Ore 182,570 "				
Increase per ton Lead and Zinc 451,762 tons @ $1.67			754,442	$2.59
Metal Not Paid for (19,433 tons @ $30.00) / 291,453			582,990	2.00
Total Lead Smelting			$1,337,432	$4.59
Increase in Zinc Smelting Charges				
259,039 tons Conc. x $6.60 = $1,709,657 / 291,453			$1,709,657	$5.87
14,052 tons Zinc Not Paid x $62.60 = $879,655 / 291,453			879,655	3.02
Total Increase Zinc Smelting per ton Metal			$2,589,312	$8.89
Increase Railroad Transportation				
Estimated Freight Costs $6,445,709 3% Tax = $193,371 / 291,453		Per ton Lead Plus Zinc		.66
Higher Valuations Ore & Concentrates				
259,039 tons Zinc Conc. @ $.50	129,519 + 3%	133,404		
750,393 tons Crude Ore @ $.20	159,079 + 3%	154,581		
	$279,598	$287,985		1.01
				$1.67

Summary Increased Costs Per Ton Lead Plus Zinc

Mine & Mill Labor	$23.01
Lead Smelting Charges	4.59
Zinc Smelting Charges	8.89
Railroad Transportation on Ore, Conc. & Metal	1.67
Supplies - 5% $4,000,000 $200,000	.68
General Overhead ($200,000)	.68
Total Increased Cost with 1939 Efficiency Before Taxes or Interest	$39.52

	Per Ton Lead Plus Zinc
Increase Cost Over 1939	$39.52
1939 Loss	15.58
Interest on $40,000,000 = $2,400,000 / 291,453	8.24
Increase in Price of Lead and Zinc over 5¢ per lb. to make 6% on investment	$63.34

With lead at 6.50 cents per lb. the price of zinc should be 10.306 to make .6% on investment, based on 1939 production and efficiency, calculated as follows:

291,453 tons	@	$61.99	$18,067,171
164,990 "	@	30.00	4,949,700
126,463 tons	@	$103.73	$13,117,471
1939		102.40	
Est. Price per ton Zinc =		$206.13	= 10.3¢ per lb.

ESTIMATE
COST OF PRODUCTION
86 MINES - 31 MILLS ROCKY MOUNTAIN AREA
1939
Dec. 28/44
E. H. Snyder

Crude Ore Mined	2,739,957 tons
Ore and Tailings Milled	2,796,971 "

Wages and Salaries					Cost Per Ton ore mined
Wages	6,384 Employees	1,682,687 Man shifts	$9,119,824		
Salaries Plant	516 "	154,800 " "	1,263,411		
Salaries General Office	300 "	90,000 " "	900,000		
Industrial Insurance, O.A.B., Unemployment			1,128,323		
Total Cost Wages and Salaries			$12,411,558	$12,411,558	$4.5300
Power Purchased (175,448,000 kwh) (Bureau of Census)				1,305,075	.4763
Fuel " " "				260,660	.0951
Supplies and Materials " " "				4,084,657	1.4908
General Overhead - Selling Expense, State Taxes, Insurance (Exclusive Federal Income Taxes)				1,806,195	.6592
Depreciation - Mill Buildings and Equipment - Estimated				784,000	.2861
Depreciation - Mine Buildings and Equipment - Estimated				1,400,000	.5110
Total Operating Costs				$22,052,145	$8.0485
Depletion - Mill Ore			$2,800,000		
Depletion - Smelting Ore			360,000		
Total Depletion			$3,160,000	3,160,000	1.1533
Estimated Total Mining and Milling Costs				$25,212,145	$9.2018
Estimated Smelter Return Value after Railroad Freight				20,671,451	7.5446
Mine and Mill Loss - 291,453 tons Lead plus Zinc @ $15.58				$ 4,540,694	$1.6572

Permission to reprint will gladly be given. Please inquire of American Mining Congress as to publication date - Booth 421

ZINC *

By W. C. Page, Asst. to Vice President
U.S. Smelting, Refining and Mining Co.

This convention of the Western Division of the American Mining Congress, the first since 1941, reminds me very forceably of that last meeting held in San Francisco just five years ago. I attended that meeting as a private, unemployed citizen. I had just arrived in San Francisco with my wife and nine year old son after landing in New York on August 25 from Lisbon, after having lived abroad for more than fourteen years, the last ten years of which were spent in Yugoslavia. I, together with my family, had gone through the German invasion which began on April 6, 1941 and the subsequent German occupation, these experiences covering a period of about six weeks. It was only by just plain good luck that we were able to eventually reach Lisbon and embark from there more than four months after the invasion.

When we first went to Yugoslavia in 1931 we did not experience much need for adjustment in our own way of life or in our economic point of view. True, there were local and national customs with which we were glad to conform, but in general people lived their own lives free of governmental restraint and the ordinary practices prevailed in the sale and purchase of most commodities, even imports and exports were handled under conditions paralleling free market prices.

In 1932, however, changes commenced. They were not felt at that time. It is only by looking back now in the light of all that has happened that one can recognize those early symptoms. Though coming slowly at first, changes in the economic life of Yugoslavia and most of Europe for that matter, moved more swiftly as one control after another was imposed by those who became more powerful with each new regulation. Before war came to Europe the economic life of the people was completely dominated by the planned economy policies of Hitler.

You may, therefore, appreciate as I appreciated the return to this country in 1941 to discover that in the hurried move from Europe to the United States I returned to a land where people still lived their own lives, still were able to buy and sell what and when and how they wished. It was like a "shock treatment". Not until then did I realize the full import of completeness of the metamorphosis that gripped Europe during our ten years stay there. Not until then did I see completely how a whole continent of people slowly and inperceptibly at first but with ever accelerating speed, lost their freedom to their own government which grew more powerful with each new directive. Trade in Europe changed to the barter system for all commodities including imports and exports. Exchange regulation procedure followed strictly according to government directive.

The production from the English Company, Trepca Mines, which I represented there eventually came almost 100% under this economy. Our production went to Germany, Italy, Hungary, Romania, Bulgaria and others by allocation from the Yugoslav Government. I must say, at this point, very emphatically, that the Yugoslav people, Government and private citizens, with whom I was associated commercially and socially and for whom I had a high admiration and respect, were not

* Presented at the 1946 Metal Mining Convention and Exposition, Western Division, The American Mining Congress, Denver, Colo., September 9-12.

the group of people who now constitute the Yugoslav Government and with whom this country has just recently had unpleasant dealings. The people we knew during those ten years had the highest admiration for the principles and policies of free enterprise as exemplified by the United States and I have little doubt but that those people, if still living, still hold those ideals. Those people were not Communists but were the last word in rugged individualism. Trepca has in recent months been nationalized.

You may well believe that I firmly thought, after spending that time under those conditions during which I was fortunate to personally observe conditions in practically all of the Balkan and other Eastern European countries and finally the German occupied Yugoslavia, that I had just about seen everything related to economic controls. Those controls were, of course, to a large extent brought about by the war which started in 1939 but in many cases had been ininiated to an extent earlier because of the shortage of exchange credits. We experience rationing of sugar, flour and butter and controlled prices on those commodities as well as metals. Lead and zinc concentrates which we produced were used by the Yugoslav Government in barter dealings with neighboring countries as payment for flour and high octane gasoline. I felt that I was fortunate when I was asked by the pre-war Yugoslav Government to personally enter into these negotiations. I was asked to do this from 1939 until war came, as a citizen of a neutral country. In this way I learned intimately the theories, practices and effects of European planned economy particularly as regards metal dealings. The people in small business, as well as peasants, strongly resisted but were submerged under the new order. They could do nothing else.

To go further, shortly after that meeting in San Francisco I was influenced, through contact of my old friend, Frank Ayer, to go to work in Washington with him in the Copper Zinc Division of O.P.M. That was about November 1, 1941. You will recall the transition that took place in Washington, particularly in the Metals Division of the War Production Board. Discussions between the various agencies commenced on plans vague and incomplete but all pointing directly to controlled economy in metals production. During those discussions I believe, without exception that everyone in the copper, lead and zinc organizations in W.P.B. strongly resisted any such plans and argued and fought for the continuation of a free market. Most of those individuals have since departed from Government service for one reason or another.

The ultimate result, as you all know, was that the Premium Price Plan was initiated as of February 1, 1942. I presume that Frank Ayer thought that my European experience would be valuable in helping to constructively administer such a plan as he appointed me the zinc member of the Quota Committee. I do not propose to review or to make any statement as to the procedures, policies, arguments or what might be called the "goings on" in that committee from the time of its original organization until I left Washington in late April of 1943. As a member of the Quota Committee it was necessary that I carry out policies, some of which were contrary to my ideas. I carried out all policies as outlined as I felt that the need to do so was created by the war emergency.

You have patiently listened to my personal experience for the past several minutes. The question obviously in your minds is, "What has this to do with this meeting of the American Mining Congress?" Since leaving Washington I have had an opportunity to view those metal policies in retrospect and currently and while I agree that the Premium Price Plan accomplished its purpose in the war period in gaining production from marginal and submarginal mines, I am of the opinion that

the mining industry as a whole would have preferred and could have devised a more practical plan. I have always felt that the Premium Price Plan was perhaps inequitable and impractical in that it does not sufficiently give incentive for efficiency in operation. I have often heard it said that the Premium Price Plan placed a premium on inefficiency. This, however, is water over the dam but it gives me this thought. We have all sensed a gradual but increasing tendency on the part of practically all producing industries, that have tasted of subsidies and other governmental relief, to relinquish initiative and self-determination. There appears everywhere to be an increasing tendency to look to Washington for financial assistance and the solution of problems by "directives" rather than for industry to depend upon its own ability and resourcefulness as in pre-war years. In brief, I feel that the inherent sense of free enterprise is becoming dulled through complacancy and appeasement just as was so evident to me among the people in Europe. I feel so strongly that the continued trend of metal controls in the United States so closely parallels in theory and application that which I had the experience of observing in Europe, that I cannot help but be concerned as to the future.

We have the Premium Price Plan with us until June 30, 1947, and my message is that the metal mining industry has ten months in which to make up its mind whether it wishes to continue production under that plan or will it, as of July 1, 1947, demand a return to free markets and free enterprise?

RESUME OF THE ZINC INDUSTRY

By Edward H. Snyder*

Taking into consideration the character and forcefulness of the producers of other metals in this audience, I have no intention of doing any bragging as to the superiority of zinc or stating my opinion as to its relative importance in the general economy. However, patients who are battling to regain health after a long illness or an "accident" generally are allowed to monopolize a reasonable period of time in which to tell of their experiences, aches, pains, and complications. I am going to take advantage of this custom to deal briefly with some of the conditions of the zinc industry, avoiding as much as possible reference to "afflictions" that plague all metal producers and business in general.

The domestic zinc industry during the nine long years from 1930 to 1938, inclusive, has suffered the adjustment involved in absorbing an average weighted price decrease of 31.3% and at the same time a reduction of 31.5% in output, resulting in an average yearly gross income of only 47% of the average for the five years 1925 to 1929, inclusive.

During 1929, with the average London price 5.4 cents per pound, the foreign industry produced approximately 989,000 tons, which was the highest production ever obtained up to that time. In 1938, foreign production totaled 1,274,000 tons for a new record high, with the average London price at 3.05 cents. The increase of 28.8% in production in the nine year period was made in spite of an apparent average price decrease of 43.5%.

While domestic production has decreased by 169,000 tons from approximately 625,000 tons in 1929 to 456,000 tons in 1938, foreign production has increased 285,000 tons from 989,000 tons in 1929 to 1,274,000 tons in 1938.

The average gross recoverable value of metals other than zinc in domestic zinc ores is less than half of that in the ores of Mexico, Canada, Australia and India, and about 60% of the values of other metals in the ores of Poland, Spain and Yugoslavia. In some cases, zinc has degenerated into a straight by-product metal in connection with the production of lead and the precious metals from high grade complex ores.

High grade foreign ores coupled with cheap labor (except in Canada) are not the only reasons for the large increase in world production, while a large portion of the domestic industry is facing a slow death. The so-called drives for self sufficiency of metals involving subsidies of various types account for a substantial production of foreign zinc under conditions not controlled by the London price level, but by the abnormal demand for gold due to the shortage of foreign exchange in most nations except the British Empire and the United States.

Germany is the outstanding example of the nations driving for self sufficiency and suffering from a shortage of foreign exchange. German zinc production increased from 56,000 short tons in 1933 to 180,000 tons in 1937, and 212,000 in 1938. The 1938 production was not quite four times that of 1933 and twice that of 1929.

The drives of other nations for self sufficiency and for something to use for money in the world's markets will continue, and the further expansion of

* Edward H. Snyder
Combined Metals Reduction Company
Presented Annual Metal Mining Convention, Western Division, The American Mining Congress, Salt Lake City, Utah, August 28,-31, 1939.

the foreign zinc industry is expected. Proposals covering the building of two electrolytic plants in South America and a third in Canada are being considered at this time. Improvement in metallurgy will also continue to add materially to the world's supply of zinc.

On the other side of the picture, the world's apparent consumption of zinc outside the United States was 21% greater in 1938 than in 1929. The 1938 consumption is estimated at 1,196,000 short tons, excess production over consumption 77,000 tons, and stocks at smelters as of January 1, 1939, 300,000 tons, equivalent to a little more than three months consumption at the current rate. No accurate figures are available as to quantities of concentrates on hand at mills and smelters, but it is believed substantial additions were also made to concentrate stocks during the past year.

A large portion of the increase in foreign consumption appears to be due to the metal used or stored for military purposes. No statistics have been published as to the quantities of zinc in the hands of governments or other consumers. Reliable opinion is that foreign consumers' stocks are large.

All factors relating to the foreign zinc situation indicate that over production of zinc outside the United States will continue at an average price closely approximating 3.0 cents per pound London until such time as Europe destroys itself with war or the leading powers agree to policies that will again permit normal world trade.

The average price differential between St. Louis and London for the first six months of 1939 was (4.5 - 2.89) 1.61 cents per pound, as compared to (6.76 - 6.46) a differential of 0.3 cent per pound for the five year period 1925 - 1929, inclusive.

The duty on zinc was reduced 20% on January 1, 1939 from 1.75 cents per pound to 1.4 cents per pound for metal, and from 1.5 cents per pound to 1.2 cents per pound for zinc in ore.

In spite of the prevailing low price of 4.5 cents per pound St. Louis (2.89 cents London), foreign imports for the first six months of 1939 of zinc plus recoverable zinc content of ores totaled 21,720 tons, of which only one-seventh came from Canada. During this period domestic stocks increased by 8,472 tons from 126,769 tons on January 1, 1939 to 135,241 tons on July 1, 1939.

The London price of zinc increased to 3.03 cents per pound late in July. This plus a sharp increase in shipments in the domestic industry boosted the domestic price to 4.60 cents on July 27 and to 4.75 cents on August 7. United States stocks decreased by 3,459 tons in July from 135,241 tons July 1 to 131,782 tons on August 1. This is the first month since the tariff reduction was announced in November 1938 that domestic stocks were reduced.

With the present United States duty of 1.4 cents per pound and a 3.0 cent price for zinc in London, the slow destruction of a large portion of the United States zinc industry is inevitable, with further tearing down of the other industries it supports.

Reviewing the previously stated facts, even those not associated with the United States zinc industry should be able to agree that any industry that has

suffered an average reduction of 53% in gross income over a period of nearly ten years is "sick". It should also be apparent to all that the future welfare of the domestic zinc industry is now controlled not only by the uncertainties of future business conditions in the United States, but also definitely by those in Europe.

Only two possible solutions of our domestic zinc problem are apparent. One is the raising of the world's price level for raw materials by the international adoption of trade and monetary policies that will permit free interchange of goods between raw material producing countries and those depending on manufacturing. Under present world conditions, chances of the adoption of sane trade and monetary policies are remote, but until this is accomplished, the only practical solution of our problem is a United States duty on zinc sufficient to maintain (with balanced production and consumption) an average domestic price above the cost of production, including the cost of development and depletion. A duty of 2.25 cents per pound is required. Our battle must continue until it is had.

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