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LEAD [1]

By E. W. Pehrson and H. M. Mey

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The lead industry in the United States was a
1938 by the decline in industrial activity at hon
toward overproduction in the foreign market. I
of refined primary lead decreased 25 percent and
27 percent from 1937. Production from foreign
more than doubled. Imports of crude materials a
lead products also increased. During the first 5
duction exceeded demand, and stocks rose steadil
second half of the year curtailment of domestic
ment in demand caused a sharp reduction in
refined metal to the lowest year-end inventory
dropped from 4.75 cents per pound at New Yo
a low of 4.00 cents in May and June, rose to 5.1
to November, and declined to 4.85 cents at the clo
average was 4.74 cents compared with 6.01 cents
quotations exceeded London prices by 1.41 cen
cent in 1937. During the latter half of 1938 wea
market retarded price improvement in the Unite

[1] This report deals primarily with the smelting, refining, and consuming
details of mining operations see separate reports issued for the various Sta

Salient statistics of the lead industry in the United States, 1925–29 (average) and 1934–38, in short tons

	1925–29 (average)	1934	1935	1936	1937	1938
Production of refined primary lead:						
From domestic ores	660,525	299,841	310,505	387,698	443,142	331,964
From foreign ores and base bullion	123,104	11,395	14,055	11,458	24,175	51,705
	783,629	311,236	324,560	399,156	467,317	383,669
Recovery of secondary lead:						
As pig lead	126,600	124,500	156,800	137,500	154,500	119,400
In alloys	153,400	83,900	113,600	125,400	120,600	105,500
	280,000	208,400	270,400	262,900	275,100	224,900
Total production of pig lead (primary and secondary)	910,229	(436,736)	481,360	536,656	621,817	503,069
Imports:[1]						
Lead in base bullion	95,747	2,450	2,602	312	1,800	15,296
Lead in ore	40,066	10,611	20,025	20,713	34,103	45,370
Exports of refined pig lead	98,048	5,909	6,982	18,313	20,091	46,866
Refined primary lead available for consumption	690,916	305,610	318,000	383,433	[2] 449,464	330,708
Estimated consumption of primary and secondary lead	900,250	488,000	538,900	633,550	678,700	540,000
Prices:						
New York:						
Average for year, cents per pound	7.47	3.86	4.03	4.71	6.01	4.74
Quotation at end of year, do	6.25	3.70	4.50	6.03	4.75	4.85
London average, do	5.87	2.46	3.12	3.91	5.15	3.33
Mine production of recoverable lead	664,230	287,339	331,103	372,919	464,892	369,726
World smelter production of lead	1,850,000	1,465,000	1,523,000	1,628,000	1,858,000	1,791,000

[1] Data include lead imported for immediate consumption plus material entering the country under bond.
[2] Revised figures.

Figure 1 shows trends in the domestic lead industry since 1900.

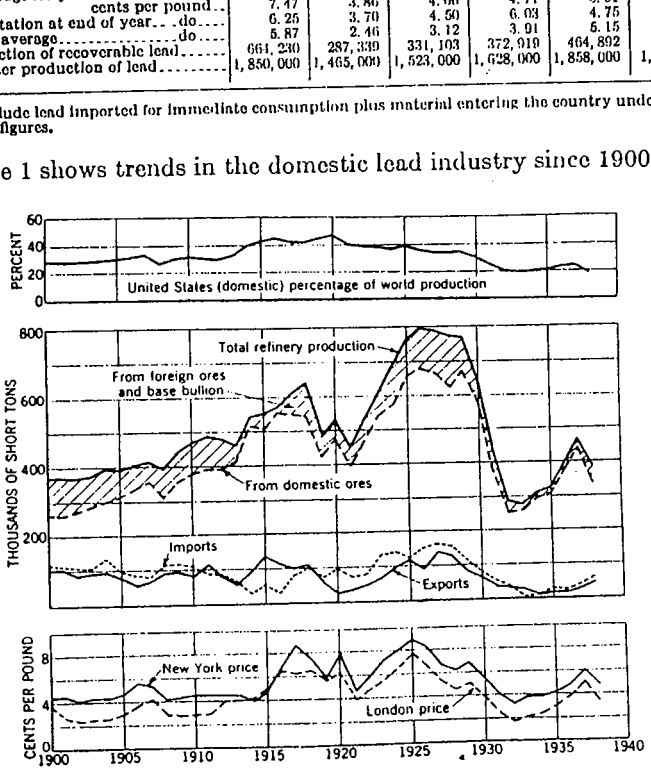

FIGURE 1.—Trends in the lead industry in the United States, 1900–1938. Imports include lead in ore, bullion, pig lead, and scrap; exports include pigs, bars, and scrap and lead exported in manufactures with benefit of draw-back.

Outside the United States smelter product again attained new peaks and continued the st persisted since 1932. Recovery abroad thus h in the United States. Foreign production in 1 cent compared with 1929, whereas that of the U 48 percent. Similarly foreign consumption i whereas domestic demand declined 45 percent. tant foreign producers except Mexico, Belgium, their smelter outputs in 1938 over 1937. How a substantial rise in mine production. Apparen United Kingdom, Germany, and Italy was hi 1937, but that in France, Japan, Belgium, and U

An event of unusual significance was the fo Producers Association in September 1938. The most of the important producers outside the U announced purpose is to balance production wit action was prompted by the depressed prices o which reached extremely low levels in June. I 1938, a 10-percent reduction in output was agre curtailment if the market failed to improve.

Trade agreements with the United Kingdom and in Minerals Yearbook, 1938, the official announ tary of State declared that the following lea considered in negotiating a trade agreement with Litharge, red lead, suboxide of lead, lead-bea mattes of all kinds, and miscellaneous commodit discussions lead ores, etc., as well as lead bullion pigs and bars, lead dross, reclaimed lead, scra combinations of lead "not specially provided sidered. At public hearings begun early in 19 filed briefs protesting any reductions in its pr final treaties were signed on November 17, 1938.

No concessions were made in either treaty on bearing ores, scrap, etc. However, in the agree Kingdom the import duty on litharge was redu ly 1939, from 2.50 to 2.25 cents per pound, that to 2.25 cents per pound, and that on lead pig provided for" (except suboxide of lead) from 30 20 percent. Other reductions were made on b tubes, and lead manufactures n. s. p. f.

The reciprocal-trade-treaty program thus far port duty on several lead products, but no change in the lead industry's basic tariff protection on producers, however, have not fared so well. In Agreement the import duty on zinc ores and sla percent. An analysis of this cut is presented in

DOMESTIC PRODUCTIO

Refined pig lead produced in the United States main sources—domestic ore, foreign ore and b ondary materials. The following table lists the of these sources from 1934 to 1938:

Total pig lead produced in the United States, 1934–38, in short tons

Year	From domestic ores and base bullion	From foreign ores and base bullion	From secondary materials	Total
1934	200,841	11,395	124,500	435,736
1935	310,505	14,055	156,800	481,360
1936	387,698	11,458	137,500	536,656
1937	443,142	24,175	154,500	621,817
1938	331,964	51,705	119,400	503,069

PRIMARY LEAD

Refinery production.—Production of refined primary lead in 1938 decreased 18 percent and was only 49 percent of the 1925–29 average. Production from domestic ores decreased 25 percent in 1938, whereas that from foreign ores and base bullion increased 114 percent. Production from foreign materials was the largest since 1931 but represented only 51 percent of the 1929 output.

Refined primary lead produced in the United States, 1934–38

Year	Production by— Classes (short tons) Desilverized lead [1] [2]	Soft lead [2] Desilverized	Soft lead [2] Undesilverized	Total production [1]	Sources (short tons) From domestic ores and base bullion	From foreign ores	From foreign base bullion	Value Average per pound	Value Total
1934	186,468	22,744	102,024	311,236	200,841	10,241	1,154	$0.037	$23,031,000
1935	102,544	35,233	90,783	324,560	310,505	13,659	390	.040	25,965,000
1936	239,044	47,402	111,750	309,156	387,698	11,401	57	.046	36,722,000
1937	272,051	55,317	139,949	467,317	443,142	23,393	782	.059	55,143,000
1938	243,891	31,986	107,792	383,669	331,964	32,862	18,843	.046	35,298,000

[1] The lead content of antimonial lead is excluded.
[2] Desilverized soft lead is excluded.
[3] Includes lead derived from Missouri ores and other nonargentiferous ores.

Source of primary lead.—Of the total refined lead produced in 1938, 87 percent was derived from domestic ores and 13 percent from foreign ores and base bullion. Production from foreign ores increased 40 percent in 1938 and was the highest since 1930. Refining of foreign bullion was resumed on a large scale in 1938, chiefly because of the closing of one of the Mexican refineries during the latter part of the year, which diverted bullion to domestic plants. Details of the sources of lead from domestic ores are given in the section on Mine Production.

Refined primary lead produced in the United States, 1934–3

Source	1934	1935
Domestic ore	200,841	310,505
Foreign ore:		
Australia	115	
Canada	2,514	1,030
Europe	46	1,080
Mexico	1,011	5,809
South America	4,028	2,872
Other foreign	2,528	2,863
	10,241	13,659
Foreign base bullion:		
Mexico	703	390
South America	461	
Other foreign		
	1,164	390
Total foreign	11,305	14,055
Grand total	311,236	324,560

Antimonial lead.—Antimonial or hard lead i product of the refining of base bullion, but the q this source is only a small part of the country' The major part is obtained from the smelting of a and some is produced by mixing metallic antimo lead.

Several lead-smelting plants operate on scrap r Production data from such plants are summariz this volume on Secondary Metals—Nonferrous. hard lead scrap also is treated at primary sme and the production of antimonial lead at these pl table that follows:

Antimonial lead produced at primary lead refine

Year	Production (short tons)	Antimony content: Short tons	Antimony content: Percent	Lead cont: From domestic ore
1934	16,007	2,303	13.6	5,901
1935	16,384	1,729	10.6	4,686
1936	23,230	2,162	9.3	7,442
1937	27,524	2,579	9.4	7,833
1938	24,123	2,809	11.6	6,759

SECONDARY LEAD

Recovery of secondary lead decreased 18 perce of battery scrap for smelting and refining declined at scrap-consuming plants were considerably high year than at the beginning. As the output of d mary lead dropped 25 percent, the ratio of second

production increased from 62 to 68 percent. Additional details on production of secondary lead in 1938 are given in the chapter in this volume on Secondary Metals—Nonferrous.

Secondary lead recovered in the United States, 1934–38

[Compiled by J. P. Dunlop]

Year	Pig lead (short tons)			Lead in alloys (short tons)	Total recovered lead		
	At primary plants	At secondary plants	Total		Short tons	Value	Ratio to domestic refined primary lead (percent)
1934	33,557	90,943	124,500	83,000	208,400	$16,421,600	70
1935	44,748	112,052	156,800	113,600	270,400	21,632,000	87
1936	34,556	102,944	137,500	125,400	262,900	24,186,800	68
1937	29,986	124,514	154,500	120,600	275,100	32,461,800	62
1938	24,800	94,600	119,400	105,500	224,900	20,690,800	68

LEAD PIGMENTS

Lead pigments manufactured in 1938 contained 174,853 tons of lead, a decrease of 21 percent from 1937. Of this total, 162,828 tons were derived from refined pig lead; white lead comprised 46 percent, litharge 37 percent, red lead 16 percent, and sublimed lead and orange mineral 1 percent. Sublimed lead and leaded zinc oxide are the principal pigments in which the lead content is derived from ores.

Lead in pigments,[1] 1934–38, by sources, in short tons

Year	Lead in pigments from—				Year	Lead in pigments from—			
	Domestic ore[2]	Metal	Scrap	Total		Domestic ore[2]	Metal	Scrap	Total
1934	7,538	157,204	379	165,211	1937	17,363	204,961	127	222,461
1935	12,109	185,151	144	197,404	1938	12,025	162,828	.....	174,853
1936	15,062	204,997	37	220,096					

[1] Includes also lead recovered in zinc oxide and leaded zinc oxide.
[2] No pigments from foreign ore.

MINE PRODUCTION

Production of lead from domestic mines in 1938 decreased 21 percent from 1937, returning to the 1936 level. All three major producing regions shared the lower rate, with percentage declines as follows: Southeastern Missouri 22 percent, Coeur d'Alene 15, and Utah 27. Output in the Bingham district fell only 9 percent, but that in the Joplin region was 22 percent lower than in 1937. The closing of the Silver King Coalition and Park Utah Consolidated mines early in 1938 was mainly responsible for the fall in output of the Park City region which, in turn, was chiefly responsible for Utah's lower production. The Butte (Mont.) district produced only 204 tons of lead in 1938 compared with 5,780 tons in 1937 and more than 10,000 tons each in 1936 and 1935. Output in the Warm Springs (Idaho), San Juan Mountains (Colo.), and Metaline (Wash.) districts reversed the general downward trend and increased 84, 18, and 52 percent, respectively. Further details of production by mines, districts, and States can be found in the various State reports.

Mine production of recoverable lead in the United Stat 1934–38, in short tons

State	1925–29 average	1934	1935
Western States and Alaska:			
Alaska	982	747	670
Arizona	0,743	3,430	7,78
California	2,070	412	567
Colorado	30,112	4,218	5,673
Idaho	141,610	71,324	79,026
Montana	18,871	10,006	16,680
Nevada	9,807	10,091	12,076
New Mexico	6,730	9,365	7,289
Oregon	0	21	30
South Dakota	21	.....	4
Texas	213	360	522
Utah	149,509	58,077	63,510
Washington	1,323	201	103
Wyoming	.....	1	3
	370,997	29,251	193,430
Central States:			
Arkansas	38	40	38
Illinois	552	40	436
Kansas	26,121	6,805	10,892
Kentucky	135	104	132
Missouri	202,240	90,493	97,403
Oklahoma	58,306	16,747	23,405
Wisconsin	1,745	234	280
	289,137	114,463	132,682
Eastern States:			
New York			
Tennessee	4,090	3,625	4,982
Virginia			
North Carolina			
	4,090	3,625	4,982
	664,230	287,339	331,103

Mine production of recoverable lead in the principal lead United States, 1934–38, in short to

District	State	1934
Southeastern Missouri region	Missouri	89,580
Coeur d'Alene region	Idaho	70,331
Bingham	Utah	32,420
Joplin region	Kansas, Missouri, Oklahoma.	24,465
Tintic	Utah	5,715
Warm Springs	Idaho	8
Park City region	Utah	12,360
San Juan Mountains	Colorado	1,051
Rush Valley	Utah	5,594
Eagle	Montana	2,560
Willow Creek	New Mexico	6,143
Oro Blanco	Arizona	1,076
Metaline	Washington	237
Wallapai	Arizona	6
Ploche	Nevada	4,644
Ophir	Utah	1,349
Old Hat	Arizona	65
Cataract	Montana	259
Leadville	Colorado	524
Hog Heaven	Montana	1
Smelter	do	976
Central	New Mexico	2,840
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	234
Tombstone	Arizona	1,200
Banner	do	77
Butte	Montana	5,391
Flint Creek	do	400
Bisbee (Warren)	Arizona	64
Tybo	Nevada	4,285
Austinville[1]	Virginia	(1)
St. Lawrence County[1]	New York	(1)

[1] Bureau of Mines not at liberty to publish figures. [2] Not lis

STOCKS

Lead stocks, as reported by the American Bureau of Metal Statistics, are shown in the following table. Stocks of refined and antimonial lead include metal held by all primary refiners and by most refiners of secondary material who produce common lead. Foreign lead refined in the United States and entered for domestic consumption is included.

Lead stocks at end of year at smelters and refineries in the United States, 1934–38, in short tons

	1934	1935	1936	1937	1938
Refined pig lead	223,593	215,595	165,159	119,837	102,489
Antimonial lead	10,437	6,711	6,697	9,294	13,413
	234,030	222,306	171,856	129,131	115,902
Lead in base bullion:					
At smelters and refineries	6,045	15,072	9,187	10,959	18,693
In transit to refineries	1,528	1,860	1,070	2,219	2,339
In process at refineries	11,567	16,233	14,100	14,413	16,600
	19,140	33,165	24,357	27,591	37,722
Lead in ore and matte and in process at smelters	60,699	58,502	50,098	52,081	50,332
	313,869	314,033	246,311	208,803	209,956

The upward trend in stocks evident in the last quarter of 1937 continued in the first half of 1938, as production continued to exceed shipments to consumers. During the latter half of the year the trend was reversed following improvement in demand and curtailment of production. Inventories of refined and antimonial lead at refineries reached a peak of 164,600 tons at the end of May, declined to 115,100 tons on December 1, and rose slightly during the last month of the year. The year-end stock of refined and antimonial lead was the lowest since 1930. The decline in the quantity of refined products on hand was offset partly by increases in stocks of base bullion and ore and matte in process.

Published data on the status of foreign lead stocks are not available, but the weak London market during 1938 and the organization of a producer's cartel to balance production and consumption suggests that large stocks of metal are held abroad.

DOMESTIC CONSUMPTION

New supply.—The following table shows the refined primary lead available for consumption from 1934 to 1938, inclusive. The figures do not take into account variations in producers' stocks, and as these have changed considerably during the past 5 years the quantities stated do not indicate the true trend in the actual consumption of new lead. The supply available for consumption in 1938 was 24 percent less than in 1937 and was equivalent to only 49 percent of the 1925–29 average. The total consumption of lead, as indicated by the second table following, fell only 20 percent.

Refined primary pig lead available for consumption ... in short tons

	1934	
Supply:		
Imports	[1] 283	
Production	311,236	3
	311,519	3
Withdrawn:		
Exports [2]	5,909	
Supply available for consumption	305,610	3

[1] Includes small quantities of old, reclaimed, and scrap lead.
[2] Includes small quantities of foreign lead reexported.
[3] Includes a small quantity, not separable, of "sheets."
[4] Revised figures.

Consumption by uses.—Owing to the retu secondary lead in discarded and obsolete ar consuming industries, the total consumpti exceeds the supply of new lead available. the American Bureau of Metal Statistics es sumption of lead by industries, 1934–38.

Lead consumed in the United States,[1] 193

Purpose	1934	
White lead	64,500	8
Red lead and litharge	42,000	4
Storage batteries	163,000	17
Cable covering	35,200	3
Building	30,000	3
Automobiles	7,300	1
Railway equipment	1,100	
Shipbuilding	200	
Ammunition	34,800	2
Terneplate	2,600	
Foil	10,200	1
Bearing metal	12,100	1
Solder	16,000	2
Type metal	13,000	1
Calking	10,000	1
Castings	5,000	
Other uses	35,000	4
	488,000	53

[1] American Bureau of Metal Statistics. These estimates are for the of whether its origin is primary or secondary. Antimonial lead is inc

Lead consumption in the United States in 1 1937 and 44 percent below the record estab batteries require more lead than any other i used in 1938 representing 31 percent of th fared better than most other important lea both in relation to 1937 and 1929; the declines respectively, from those 2 years. Although large requirements of lead for the manufact lead withdrawn for this use returns quickly to of scrap and there competes with primary m

stated, lead so used is more in the nature of a loan. The quantity of lead consumed in foil was 1 percent higher in 1938 than in 1937 but 45 percent lower than in 1929, while that used for red lead and litharge, exclusive of the quantities of these pigments consumed in storage batteries, was 25 percent below 1937 but 43 percent above 1929. As has been stated in recent chapters of this series, the principal difficulties of the lead industry from the standpoint of consumption are due to the failure of the utility industry to purchase its proportionate share of the total and the low requirements of the building industry. Quantities used by both of these industries rose in 1937, but they declined again in 1938 and represented only 27 and 38 percent, respectively, of the totals for 1929. White lead is a most important outlet for lead, not only because of the large tonnage involved but particularly because metal so consumed is dissipated. Early in 1939 the Lead Industries Association, with this in mind, announced a 3-year promotion campaign designed to increase the use of white-lead paint.

PRICES

The two major markets for lead in the United States are New York and St. Louis; much of the lead produced in the United States is sold at prices based on quotations in these markets. The New York quotations are influenced to some extent by the lower prices usually prevailing on the London market, so that the New York price seldom exceeds the St. Louis price by as much as the freight differential, which normally is 0.35 cent a pound.

The New York quotation for common lead averaged 4.74 cents a pound in 1938, a decrease of 21 percent from 1937, but slightly above the 4.71 cents recorded for 1936. The price was 4.75 cents as the year began, following a decline from 6.50 cents in September 1937. It increased slightly in January but resumed its downward trend at the end of the month, reaching 4 cents at the end of May, the lowest quotation of the year. During this period shipments were continuously below production, and refinery stocks advanced from 90,742 tons at the end of September 1937 to 164,636 at the end of May 1938. A virtual balance between output and shipments was attained in June, and stocks declined from then until December. Heavy buying of lead took place in June and July, and the price advanced 0.75 cent in June to 4.75 cents and continued upward to 5.12½ cents in September. During July and August weakness in the London position deterred price improvement in New York. In September important foreign producers met and decided on a 10-percent reduction in output. This action improved sentiment abroad and reacted favorably on the New York market. Sales were at a high level in the last quarter except for about 4 weeks beginning the middle of November. Sales jumped following a reduction in price to 4.75 cents in December. They were 16,287 tons in 1 week, and the price was raised to 4.85 cents, at which level it closed the year.

Average monthly and yearly quoted prices of lead at St. . London, 1936–38, in cents per pou

Month	1936			1937		
	St. Louis	New York	London	St. Louis	New York	Lo do
January	4.36	4.60	3.41	5.86	6.03	5.
February	4.37	4.52	3.58	6.09	6.26	6.
March	4.45	4.60	3.69	7.05	7.20	7.
April	4.45	4.60	3.55	6.03	6.18	5.
May	4.45	4.60	3.45	5.85	6.00	5.
June	4.45	4.60	3.40	5.85	6.00	5.
July	4.45	4.60	3.55	5.85	6.00	5.
August	4.45	4.60	3.70	6.30	6.46	5.
September	4.45	4.60	4.05	6.23	6.39	4.
October	4.49	4.65	4.03	5.56	5.71	4.
November	4.96	5.14	4.74	4.88	5.03	3.
December	5.40	5.57	5.60	4.72	4.86	3.
Average	4.56	4.71	[1] 3.91	5.86	6.01	[1] 5.

[1] St. Louis: Metal Statistics, 1939, p. 423. Average daily quotations of so Louis (open market), as reported daily in the American Metal Market.
New York: American Metal Market, daily issues. Pig lead, New York (ou ment from West.
London: Metal Statistics, 1939, p. 427. Average price of foreign lead. Pric in Metal Statistics, converted to cents per pound at average exchange rate repo Board.
[2] London quotations in pounds sterling per long ton, as follows: 1936, £1 £15.2667.

The London quotation ranged from a high monthl cents a pound (United States exchange basis) in Ja 3.09 cents in June. It advanced to 3.44 cents in Oc to 3.15 cents in December. The differential be prices in the New York and London markets wa 1938 than in 1937. It was lowest in March (0.94 in August (1.77 cents). The difference in price av for the year compared with 0.86 cent in 1937 and 0.

FOREIGN TRADE [2]

The foreign trade of the United States in lead imports of ore and base bullion, which are smelted ar and the export of this lead either as pig lead or products. This trade reached a peak in 1927 but small proportions in 1933. Since then, however, th stantial improvement. Imports of lead in ore, refined and scrap lead totaled 161,389 tons in 1927, 7 and 63,901 tons in 1938; exports of refined lead decre tons in 1927 to 5,909 in 1934 and advanced to 45, In the same years exports of lead in manufacture draw-back were 12,004, 7,472 and 9,061 tons, respe

Imports.—Total imports of lead in ore and matte, for immediate consumption and entries for wareho percent in 1938 owing chiefly to larger shipmen Australia, and Chile. Imports of base bullion from

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Bureau of Foreign and Domestic Commerce.

increased substantially, but the quantity of refined lead and scrap received from abroad declined. Most of the refined lead imported in 1938 came from Peru. Total imports of lead in all the above forms increased 57 percent over 1937.

Total lead imported into the United States, 1934–38, by classes, in short tons [1]

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1934	10,611	2,450	283	13,344
1935	20,025	2,692	1,322	24,039
1936	20,713	312	2,590	23,615
1937	34,103	1,800	4,903	40,806
1938	45,370	15,296	3,235	63,901

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

Total lead imported into the United States, in ore, base bullion, and refined, 1934–38, by countries, in short tons [1]

Year	Canada	Mexico	Newfoundland	South America	Europe	Other countries	Total
1934	1,160	3,270	3,357	5,455	67	35	13,344
1935	236	9,786	6,837	6,643	512	25	24,039
1936	1,692	10,501	3,955	6,861	341	265	23,615
1937	5,749	17,068	.....	13,220	535	4,225	40,806
1938	3,174	38,467	.....	13,420	680	8,154	63,901

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

Total lead imported into the United States in ore, matte, and base bullion, 1934–38, by countries, in short tons [1]

Country	1934	1935	1936	1937	1938
In ore and matte:					
Canada	902	68	1,419	5,211	3,173
Chile	1,443	1,102	574	474	2,107
Mexico	1,283	7,986	10,462	15,970	24,023
Newfoundland	3,357	6,818	3,955	.....	.....
Peru	3,545	3,710	4,007	10,132	9,317
Other countries	81	345	296	2,316	6,750
	10,611	20,025	20,713	34,103	45,370
In base bullion:					
Mexico	1,987	1,746	39	1,067	14,444
Peru	403	784	52	230	198
Other countries	.....	162	221	404	654
	2,450	2,692	312	1,800	15,296

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

Lead remaining in warehouses in the United States, Dec. 31, 1934–38, in short tons

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

Year	Lead in ore and matte	Lead in base bullion [1]	Year	Lead in ore and matte	Lead in base bullion [1]
1934	15,709	606	1937	57,509	2,622
1935	22,598	2,173	1938	76,287	11,634
1936	33,401	1,930			

[1] Pigs, bars, sheets, and old lead included with basebullion.

Lead[1] *imported for consumption in the United S*

Year	Lead in ores, flue dust, and mattes, n. s. p. f.		Lead in base bullion		Pigs and bars	
	Short tons	Value	Short tons	Value	Short tons	Value
1934	10,700	$558,558	2,220	$117,729	.....	.....
1935	8,273	268,954	1,154	60,559	1,308	$83,84
1936	5,836	226,568	763	45,340	1,070	97,01
1937	5,613	507,945	188	12,788	2,355	174,07
1938	6,722	543,164	304	31,147	2,001	84,10

[1] In addition 285 tons valued at $10,678 of "reclaimed, scrap, etc." we
in 1935; 342 tons, $23,534 in 1936; 349 tons, $30,810 in 1937; and 189 tons, $
value.

Miscellaneous products containing lead imported for States, 1934–38

Year	Babbitt metal, solder, white metal, and other combinations containing lead			
	Gross weight (short tons)	Lead content (short tons)	Value	(sh
1934	709	102	$71,605	
1935	128	24	44,269	
1936	334	67	112,205	
1937	618	178	213,734	
1938	390	77	120,660	

Exports.—Exports of pigs, bars, and old lead
1938 as a result of the increase in custom sme
foreign ores and base bullion. A large part of the
to Japan, which purchased over four times as mu
During the past 3 years substantial tonnages h
Mexico. This lead was base bullion derived fro
returned to Mexico for refining.

Lead exported from the United States 19

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of draw-back (short tons)	Year	Pigs,
	Short tons	Value			Short to
1934	5,000	$305,094	7,472	1937	20,0
1935	0,982	472,017	8,905	1938	[2] 45,8
1936	18,313	1,390,454	8,312		

[1] Includes small quantities of foreign lead reexported.
[2] Contains sheets and pipes; figures not separable.

Pig lead[1] *exported from the United States, 1934–38, by destinations, in short tons*

Destination	1934	1935	1936	1937	1938
Countries:					
Argentina	(2)		3	8	10
Brazil	475	338	705	652	110
Canada	21	45	45	7	101
Finland					560
Germany		11	2	568	1,092
Japan	4,454	5,324	8,029	7,320	30,203
Kwantung					314
Mexico	21	38	8,010	8,122	11,403
Netherlands	4	188			
Philippine Islands	169	217	223	560	1,037
United Kingdom	36	8	123	2,226	78
Uruguay	221	112			
Other countries	508	701	444	619	958
	5,909	6,982	18,313	20,091	45,866
Continents:					
North America	107	157	8,282	8,337	12,002
South America	1,076	668	1,021	784	303
Europe	40	212	133	2,949	1,950
Asia	4,684	5,945	8,865	7,989	31,606
Africa and Oceania	2	(2)	12	32	5

[1] Includes small quantities of foreign lead reexported.
[2] Less than 1 ton.

TECHNOLOGY

Mining.—Ore pillars in the Southeast Missouri district are being mined and replaced with concrete. Preliminary attempts on some of the smaller pillars have been successful, and plans are under way for mining larger blocks of ore left for roof support. One of the major problems involved is the determination of the load carried by the pillar in order that the volume of concrete used may be kept at a minimum compatible with safety. In this connection the Bureau of Mines method[3] of ascertaining rock pressures by measuring the velocity of sound is being investigated as a practical means of measuring the load on the pillars.

Probert[4] and Parks[5] have summarized progress in mining technique during 1938, and articles by Schmitt[6] and Behre[7] review recent developments in mining geology. Drilling practice in the Tri-State region has been described by Nicolson.[8]

Milling.—According to Engelmann, Minerec A is now being used in about 80 percent of the western lead-zinc mills, where it has partly or completely replaced xanthate in the lead circuits. The new sloping-side Fagergren flotation machine has found favor with lead-zinc operators.[9] Fahrenwald[10] reports substantial improvement in ore-dressing practice and equipment during 1938. A method of treating lead-zinc-fluorspar ores by flotation has been developed by the Bureau

[3] Obert, Leonard, Measurement of Pressure on Rock Pillars in Underground Mines: Bureau of Mines Rept. of Investigations 3444, 1939, 13 pp.
[4] Probert, Frank H., Some Trends in Mining Practice: Eng. and Min. Jour., vol. 140, No. 2, February 1939, pp. 68–69.
[5] Parks, R. D., Mining Progress: Min. and Met., vol. 20, No. 385, January 1939, pp. 3–5.
[6] Schmitt, Harrison, Mining Geology Looks Toward Realism: Eng. and Min. Jour., vol. 140, No. 2, February 1939, pp. 69–73.
[7] Behre, Chas. H. Jr., Mining Geology: Min. and Met., vol. 20, No. 385, January 1939, pp. 16–18.
[8] Nicolson, C. W., Recent Improvements in the Mining Practice of the Tri-State District: Am. Inst. Min. and Met. Eng., Min. Technol., vol. 2, No. 3, May 1938, 17 pp.
[9] Engelmann, E. W., Ore Concentration and Gold Milling: Min. and Met., vol. 20, No. 395, January 1939, pp. 13–16.
[10] Fahrenwald, A. W., Older Ore Dressing Practices Restudied: Eng. and Min. Jour., vol. 140, No. 2, February 1939, pp. 73–75.

of Mines.[11] The mill of the Hecla Mining
been modernized and the capacity increase
day.

Smelting.—According to Oldright,[12] advanc
1938 was confined to further development
practice. The tendency toward adoption of
and efforts to increase the capacity of bl
Fleming [13] called attention to the fact that
charge yielding a slag containing 20 perce
treated daily in a standard-size blast furnace
such tonnages were realized only when the zi
refining lead the removal of bismuth alway
particularly in producing corroding grades.
and potassium for this purpose has been
Patent 2,133,327, October 18, 1938).

WORLD ASPECTS OF LEAD I

International cooperation.—Unsatisfactory c
dustry during the latter part of 1938 culmina
principal foreign producers in London on Se
Lead Producers Association was formed. T
issued after the meeting gave few details but i
of the cartel was to restrict output to balan
consumption and thus improve prices. Acc
membership included producers in Australia,
Canada, as well as the American Smelting &
extensive lead-mining interests in Mexico, Au
land. This group represents 60 to 75 percent
duction, and it is planned to invite other pro
the scheme. Effective November 1 a 10-per
duction was agreed upon with further curtail
the market failed to improve. This was the fir
to control the lead market since the Intern
Lead Producers collapsed in 1932 as a result
import duty on lead in the United Kingdom.
ducers have cooperated in exchanging statistics

World production.—World smelter productio
4 percent below the total for 1937 and was equi
the record output in 1929. The relatively good
was due to the fact that output abroad was at
attained, slightly exceeding the previous record
duction in the United States declined 22 perce
producers and the percentage of the total outp
1938 were: United States 20, Australia 15, M
Germany 11, Belgium 5, Burma 5, the U. S. S. R
Of the important lead-smelting countries,
increase of 1 percent, Germany 6, Burma 3, the
and France 12. There was very little change i

[11] Clemmer, J. B., Duncan, W. E., DeVaney, F. D., and Guggenheim,
Lead-Zinc-Fluorspar Ores: Bureau of Mines Rept. of Investigations 343
[12] Oldright, O. L., Lead Smelting Practice Advances: Eng. and Min. Jo
70–80.
[13] Fleming, E. P., Metallurgy of Lead: Min. and Met., vol. 20, No. 385,

for brass, 29,000 tons for oxide, 20,000 tons for rolled products, 12,000 tons for die casting, and 4,000 tons for miscellaneous uses. Approximately 30 percent of the slab zinc used was supplied by domestic smelters operating largely on imported ores and 70 percent by imported metal. Imports of ore totaled 158,000 tons in 1938, of which nearly 110,000 tons came from Australia and over 45,000 tons from Newfoundland; 151,000 tons of ore were imported in 1937. Imports of slab zinc fell from 177,000 to 165,000 tons. The larger part of the metal likewise is obtained from other British countries. Shipments from Belgium declined from 57,000 to 37,000 tons. Stocks of zinc in official warehouses were 20,200 tons at the beginning and 25,400 at the close of the year. Mine production increased only slightly and amounted to approximately 6,000 tons of recoverable zinc.

Agitation for increased tariff protection for the domestic smelting industry continued during 1938. The present import duty on non-British zinc is 12s. 6d. per ton or 10 percent ad valorem, whichever is less. Early in 1939 it was proposed to raise the import duty to 30s. with a corresponding rise in the premium on Empire zinc. Of the 17s. 6d. increase in premium on Empire zinc, 10s. would be paid to Imperial Smelting Corporation as a direct subsidy and 5s. would go into a rebate pool from which zinc manufacturers would be paid draw-back on exported goods. It was reported that consumers objected to this scheme.

Yugoslavia.—Trepca Mines, Ltd., treated 655,892 metric tons of ore from its own mines in the year ended September 30, 1938, compared with 638,729 tons in the previous year. Despite the larger tonnage of ore treated the quantity of zinc concentrates produced increased only from 69,863 to 70,120 tons. In addition 101,608 tons were milled for Kopaonik Mines, Ltd., from October 1, 1937, to June 10, 1938, at which time production at the Vojetin mine of the company was discontinued because of low prices. In August 1938, the properties of the Kopaonik, Zletovo, and Novo Brdo companies were absorbed by Trepca Mines, Ltd. An agreement has been made with the Government whereby Trepca will construct an electrolytic zinc plant at Sobac with an annual capacity of 10,000 tons of metal. In the fiscal year 1938 Trepca shipped 8,000 tons of concentrates to local smelters and exported 62,000 tons, chiefly to Belgium and France.

LEAD AND ZINC PIGMENTS AND ZIN

By H. M. Meyer and A. W. Mitchel

SUMMARY OUTLINE

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Zinc pigments and salts	

The lead and zinc pigments industry was affected satisfactory conditions in the principal industries th ments—manufacturers of paint, automobiles, pneun storage batteries. On the whole pigment consumptio level in the early months of the year and improve industrial conditions in the third quarter. Despite final quarter most pigments were selling higher th levels of the year as 1938 ended.

Salient statistics of the lead and zinc pigments industry of the Unit (average) and 1934–38

	1925–29 (average)	1934	1935	1936	
Production (sales) of principal pigments:					
White lead (dry and in oil) short tons	164,483	78,734	90,831	118,407	
Litharge do	84,845	68,733	79,930	80,246	
Red lead do	41,262	26,743	28,776	34,896	
Zinc oxide do	154,208	87,088	99,697	120,800	
Leaded zinc oxide do	26,009	20,506	20,976	40,512	
Lithopone do	177,745	145,565	159,486	158,319	
Value of products:					
All lead pigments	$60,092,000	$24,002,000	$28,064,000	$34,200,000	$3
All zinc pigments	41,314,000	24,106,000	26,500,000	27,862,000	2
Total	101,406,000	48,108,000	54,564,000	62,068,000	6
Value per ton received by producers:					
White lead (dry)	178	120	124	126	
Litharge	176	103	104	116	
Red lead	193	123	121	133	
Zinc oxide	133	113	103	90	
Leaded zinc oxide	124	98	93	87	
Lithopone	98	84	84	82	
Foreign trade:					
Lead pigments:					
Value of exports	1,346,000	404,000	512,000	546,000	
Value of imports	30,000	4,000	2,000	12,000	
Zinc pigments:					
Value of exports	2,150,000	395,000	302,000	420,000	
Value of imports	931,000	373,000	408,000	375,000	
Export balance	2,535,000	422,000	434,000	579,000	

Apparently Japanese restrictions on imports of zinc metal and residues have seriously curtailed zinc oxide trade in that country. According to the Bureau of Foreign and Domestic Commerce[1] the annual production of zinc oxide in Japan was estimated at 30,000 tons, requiring about 35 percent of the total zinc imports into the country. The report also stated that most of the zinc oxide produced is consumed domestically, about 40 percent going to the paint and varnish trades and 30 percent to rubber manufacturers. A later report stated that the restrictions noted were forcing substitution of titanium pigments and lithopone for zinc oxide.

Two articles[2] published in 1938 may be of interest to the pigments industries.

Although zinc pigments fell 22 percent in total quantity compared with only 9 percent for lead pigments, they actually fared better than the latter, for they declined only 17 percent in total value compared with 21 percent. Of the principal pigments sold the average values received by producers ranged from 11 to 15 percent lower for lead pigments compared with gains in average values for zinc pigments of 1 to 14 percent. Zinc pigments made a better showing in relation to 1925–29 averages also, the total value of zinc pigments in 1938 being 56 percent of the average for 1925–29 compared with 47 percent for lead pigments. The continuing trend toward leaded grades of zinc oxide is shown in the decline of only 5 percent in pigments of this class from the high record tonnages for 1937 and 1936 compared with a decline of 31 percent from 1937 in lead-free zinc oxide. The quoted prices for lead pigments in general followed those for pig lead, receding to the low point of 1938 in midyear and rising in the third quarter. Zinc pigments were unresponsive to price changes for the metal. Prices for some were unchanged from quotations for 1937 and for others were established throughout the year at the best levels attained in 1937.

Titanium pigments again absorbed a larger share of the market for white pigments than in previous years.

PRODUCTION

In this report sales are used as being more significant than production, for no account is taken of stocks on hand at the beginning and end of the year. The quantities consumed by the producers in manufacturing products at their own plants are included under sales. Production figures are used only in calculating the metal content of pigments and salts in the section of this report on Raw Materials Used in the Manufacture of Lead and Zinc Pigments and Zinc Salts.

The total value of lead and zinc pigments dropped from $63,714,000 in 1937 to $51,505,000 in 1938—only about one-half of the average annual total for 1925–29. The decline is explained by smaller total sales of all important pigments except white lead and by lower sales values of the lead pigment group. The higher average values received for zinc pigments in a small measure offset the drop in tonnage for this group.

[1] Bureau of Foreign and Domestic Commerce, World Trade Notes on Chemicals and Allied Products: Vol. 12, No. 23, June 4, 1938, p. 400.

[2] Robertson, D. W., and Hoback, W. H., Survey of House Paint Primer Technology: Paint, Oil, and Chem. Rev., vol. 100, No. 3, Feb. 3, 1938, pp. 1, 16, 18, and 38.
Oil, Paint, and Drug Reporter, White Pigments in Enamel Tints: Vol. 134, No. 18, Oct. 31, 1938, p. 44.

Lead pigments.—Sales of all lead pigme
oil declined in 1938. White lead (dry) sale
the 7-percent increase in sales of white lea
explain a 1-percent increase in total whi
sales were 11 percent lower and those for
sulfate 18 percent and 33 percent lower, r
for basic lead sulfate do not represent a true
of this pigment consumed, as they are exclu
in the manufacture of leaded zinc oxide.
sulfate has expanded sharply in recent ye
7,000 tons was so consumed. Litharge m
relation to 1925–29 averages, the total fo
percent of the average for 1925–29, while sa
lead (dry and in oil) were 73 and 64 percent,

Lead pigments sold by domestic manufacturers in t

Pigment	1937		
	Short tons	Value (at plant, c clusive of containe	
		Total	Avera
Basic lead sulfate or sublimed lead:			
White	7,514	$973,214	$13
Blue	1,108	147,298	13
Red lead	33,031	5,429,182	16
Orange mineral	200	49,356	24
Litharge	83,902	12,033,949	14
White lead:			
Dry	32,661	4,576,337	14
In oil[1]	65,552	12,466,396	19

[1] Weight of white lead only but value of paste.

Lead pigments sold by domestic manufacturers in the
in short tons

Year	White lead		Basic lead sulfa or sublimed lea	
	Dry	In oil	White	Blue
1934	22,509	50,165	6,390	6
1935	27,972	68,859	7,572	7
1936	34,775	83,032	7,531	8
1937	32,661	65,552	7,514	1,1
1938	28,583	70,400	5,030	7

Zinc pigments and salts.—Sales of leaded zi
only 5 percent below the record tonnages for 193
for lead-free zinc oxide and lithopone fell 31 a
tively, from 1937. Contrary to the trend fo
average values received by producers for zinc
oxide increased in 1938 and were responsible f
in total value for zinc pigments than that for l
a larger decrease in total quantity. Sales of
1938 were 44 percent higher than the average an
while those for zinc oxide and lithopone were
percent, respectively.

Large amounts of basic lead sulfate are now used in making leaded zinc oxide. Such quantities are included as part of the leaded zinc oxide total and, to avoid duplication, are not shown as basic lead sulfate.

Complete data covering the production of zinc chloride in recent years are not available owing to the refusal of one large producer to supply an accurate report.

Sales of zinc sulfate declined 26 percent from the high record established in 1937.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1937–38

Pigment or salt	1937			1938		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [1]	114,652	$11,777,131	$103	79,129	$9,253,342	$117
Leaded zinc oxide [1]	40,343	4,190,952	104	38,216	4,072,422	107
Lithopone	154,771	12,069,700	78	125,746	9,975,012	79
Zinc chloride, 50° B	(2)	(2)	(2)	(2)	(2)	(2)
Zinc sulfate	10,521	580,017	56	7,757	430,479	57

[1] Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide.
[2] Data not available.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1934–38, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1934	87,088	20,500	145,565	19,614	[1] 7,379
1935	90,607	29,970	159,480	(2)	[1] 7,892
1936	126,800	40,512	158,319	(2)	[1] 9,721
1937	114,652	40,343	154,771	(2)	10,521
1938	79,129	38,216	125,746	(2)	7,757

[1] Revised figures.
[2] Data not available.

CONSUMPTION BY INDUSTRIES

White lead.—Sales of white lead (dry and in oil) withstood unsatisfactory marketing conditions in 1938 better than other lead and zinc pigments. The total increased 1 percent compared with declines of 5 to 31 percent in the other principal pigments. About 95 percent of the white lead made is used in the manufacture of paint. The quantity consumed for this purpose in 1938 was relatively unchanged from 1937 but amounted to only 69 percent of the tonnage so used in 1929. Early in 1939 the Lead Industries Association announced a 3-year promotion campaign designed to increase the use of white lead paint. The campaign will include identification of white lead as "the most durable." Increased consumption of white lead paint would benefit the lead industry more than increases in almost any other use, for metal so used is dissipated, whereas that used in storage batteries, cable coverings, building, and for similar purposes returns to the market as scrap.

Distribution of white lead (dry and in oil) sales, 1934–38,

Industry	1934	1935
Paint	75,008	91,20
Ceramics	1,434	1,83
Other	2,292	3,70
	78,734	96,83

Basic lead sulfate.—The outstanding use of l the manufacture of paint, and 87 percent of th 1938 was sold for that purpose. Increasing qua are being used annually in making leaded zinc ox used are included in the totals for leaded zinc ox the totals for basic lead sulfate to avoid duplic of lead tonnages. In 1938, 7,000 tons of basic lea making leaded zinc oxide compared with 5,500 t

Distribution of basic lead sulfate sales, 1934–38, by in

Industry	1934	1935
Paints	6,611	7,770
Rubber	93	155
Storage batteries	130	
Other	224	374
	7,067	8,299

Litharge.—Although total sales of litharge fel the quantity sold for use in the manufacture of s principal use of this pigment—was maintained a other uses except linoleum showed more than th 1937. Less lead oxide was used in making ba the output of black oxide or suboxide of lead by b declined from the peak output of 42,000 tons in in 1938. The figures on black oxide are not in Mines totals for litharge. Since 1931 insectic second most important use of litharge. In 1938 declined 36 percent from the high record establis mation received in 1939 made it necessary to revis distribution of sales of litharge by uses for 1934- from a comparison of the following table and on page 159 of Minerals Yearbook, 1938. Sales chrome pigments for that period have been overs varnish and paints have been understated.

Distribution of litharge sales, 1934–38, by industri

Industry	1934	1935
Storage batteries	30,024	36,007
Insecticides	12,271	14,605
Oil refining	7,014	7,809
Ceramics	6,096	6,751
Chrome pigments	[1] 5,084	[1] 6,617
Varnish	[1] 1,402	[1] 1,610
Rubber	2,466	3,171
Linoleum	[1] 88	[1] 220
Other	[1] 2,908	[1] 2,960
	68,733	79,930

[1] Revised figures.

Red lead.—The principal use of red lead is in the manufacture of storage batteries, and the quantity employed for that purpose declined only 6 percent in 1938 compared with a drop of 11 percent in total red lead sales. A new process for the manufacture of this product was reported in a lecture at Birmingham, England, and is described briefly in the Oil, Paint, and Drug Reporter.[3] The process consists of direct vaporization of pure lead in an electric arc furnace and passing of the lead vapor into a precipitating chamber where it mixes with pure oxygen and, with temperature, pressure, and feeds under control, produces the new-type red lead. Higher corrosion-resisting properties and almost twice the covering qualities of standard red lead are claimed for the new commodity. A plant that will use this process was erected at Beeston, England.

Distribution of red lead sales, 1934–38, by industries, in short tons

Industry	1934	1935	1936	1937	1938
Storage batteries	15,987	17,657	20,323	20,275	19,057
Paints	8,766	8,721	11,780	10,440	8,698
Ceramics	605	867	807	854	655
Other	1,305	1,531	1,980	2,362	1,773
	26,743	28,776	34,890	33,931	30,183

Orange mineral.—Sales of orange mineral fell 38 percent in 1938. The principal use shifted back to color pigments again after ink manufacture had ranked first for the 1 year—1937.

Distribution of orange mineral sales, 1934–38, by industries, in short tons

Industry	1934	1935	1936	1937	1938
Ink manufacture	24	85	71	76	20
Color pigments	68	125	77	51	94
Other	142	42	100	79	13
	234	252	248	206	127

Zinc oxide.—The principal use of zinc oxide is in the manufacture of rubber, and sales for that purpose declined in the same proportion as total sales—31 percent. Sales for use in paints fell only 25 percent; but those for floor coverings and textiles, which gained against the trend in 1937, had the sharpest drop of all—66 percent. Ceramics withstood the downtrend well, declining only 6 percent. Of the production for 1938, 62 percent was made by the American process and 38 percent by the French process compared with 69 and 31 percent, respectively, in 1937. The ratio of American to French process zinc oxide in 1937 is believed to have been unduly high, owing to the tight situation regarding supplies of metal during part of that year, and the ratio in 1938 continues above that for other recent years. The proportion of French-process oxide made from scrap zinc increased again, rising from 25 percent in 1937 to 32 percent in 1938. A large amount of zinc oxide is used in the manufacture of leaded zinc oxide. This tonnage is included in the totals for leaded zinc oxide and is excluded

[3] Oil, Paint, and Drug Reporter, New-Process Red Lead: Vol. 133, No. 24, June 13, 1938, p. 61.

from zinc oxide totals to avoid duplicat
tonnages. Zinc oxide uses in paint were

Distribution of zinc oxide sales, 1934–38,

Industry	1934
Rubber	50,145
Paints	23,741
Ceramics	2,963
Floor coverings and textiles	4,781
Other	5,458
	87,088

Leaded zinc oxide.—The manufacture of
leaded zinc oxide made, 98 or more percen
for this purpose. This pigment has beco
recent years, and sales thereof were at a re
1937. In 1938 sales declined 5 percent,
indicated for any other pigment except whi
includes about 7,000 tons of basic lead s
lead content of this product; this tonnage
sulfate totals to avoid duplication in reporti
zinc oxide was discussed by Eide and Dep

Distribution of leaded zinc oxide sales, 1934–38

Industry	1934
Paints	20,376
Rubber	28
Other	102
	20,506

Lithopone.—Sales of lithopone in 1938 dro
in 1937. The percentage of the total used i
has increased in recent years; it was 73 pe
and 81 in 1938. Lithopone statistics are
regular lithopone content of high-streng
lithopone sold as such. Prior to 1936 the
of standard-strength plus high-strength pr
increased use of high-strength lithopone
lithopone by the floor coverings and texti
dustries fell considerably more in proportio
basis of somewhat incomplete information,
shown in the following table for floor cover
that 10,800 tons were for linoleum and fel
the remainder for coated fabrics and texti
artificial leather, etc.). "Other uses" in
used for paper and 477 tons for printing in

Nelson, Harley A., Zinc Oxide Uses in Paint: Oil, Paint, and
pp. 5, 34.
Eide, A. O., and Depew, Harlan A., Leaded Zinc Oxides—Th
ture: Drugs, Oils and Paints, vol. 54, No. 4, April 1939, pp. 119–

Distribution of lithopone sales, 1934–38, by industries, in short tons

Industry	1934	1935	1936	1937	1938
Paints, etc.	114,472	124,615	122,461	122,015	101,924
Floor coverings and textiles	14,811	19,440	23,085	20,194	15,400
Rubber	4,596	4,435	4,908	4,383	3,148
Other	11,686	10,996	7,865	7,279	5,274
	145,565	159,486	158,319	154,771	125,746

The use of ordinary-strength lithopone in the manufacture of titanated lithopone, which usually contains about 15 percent TiO_2, has increased sharply since the output of this product began. There was a drop in 1938, however, when 17,000 tons were used for this purpose compared with 19,400 tons in 1937.

Zinc sulfide.—Production of zinc sulfide was reported by four plants in 1938; but owing to the fact that one producer represents such a large part of the total, the Bureau of Mines cannot publish representative statistics. Most of the zinc sulfide is mixed with regular lithopone to make high-strength lithopone.

Zinc chloride.—The Bureau of Mines cannot report zinc chloride production because of the refusal of one of the large producers to supply reliable data.

Complete data on sales of zinc chloride are not available, but returns from producers representing two-thirds or more of the output indicate the following distribution of sales by uses in 1938:

	Percent		Percent
Soldering flux	40	Oil refining	4
Wood preserving	24	Others	7
Dry-cell batteries	14		100
Vulcanized fiber	11		

Zinc sulfate.—The trend of sales of zinc sulfate was upward from 1932 to 1937, and a new high record rate was established in 1937. In 1938 sales fell 26 percent from those in 1937. Efforts to obtain figures covering the distribution of sales of zinc sulfate were more successful in 1938 than in previous years. Of the total sales (7,757 tons), 2,851 tons were reported as sold to the rayon industry, 1,664 tons for agricultural purposes, 947 tons for chemicals, 656 tons to paint and varnish manufacturers, 285 tons for glue manufacture, 284 tons to electro-galvanizers, and 59 tons to printers and dyers of textiles; 948 tons were undistributed.

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

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and such miscellaneous secondary materials as scrap and waste from various industrial processes. In 1938, 93 percent of the lead in lead pigments was derived from pig lead and 7 percent from ore. The proportions for zinc pigments in 1938 were 67 percent from ore, 15 percent from slab zinc, and 18 percent from secondary materials.

Metal content of lead and zinc pigments produced 38, by sources, in short

Source	Lead pigmen
Domestic ore	17,
Metal	204,
Secondary material [3]	
	222,

[1] Includes also lead recovered in zinc oxide and leaded zinc oxid
[2] Revised figures.
[3] Zinc ashes, skimmings, drosses, and old metal.

The following tables give the source of t facture of each pigment and salt. Pig le either directly or indirectly, in the manufac red lead, and orange mineral, as well as i lead sulfate. Zinc oxide is the only pign slab zinc is used. Ore is employed in the leaded zinc oxide, lithopone, zinc sulfate, substantial proportion of the zinc in lithop in the United States is derived from secon been a decided increase in the quantity o in the manufacture of zinc oxide since displaced slab zinc in the manufacture of F

Lead content of lead and zinc pigments produced by d by sources, in short to

Pigment	1937			
	Lead in pigments produced from—			Total lead in pigments
	Domestic ore	Pig lead	Secondary material	
White lead		90,791		90,791
Red lead		32,080		32,080
Litharge		79,704		79,704
Orange mineral		237		237
Basic lead sulfate	5,555	977		6,532
Leaded zinc oxide	11,808	266	127	12,201
	17,363	204,961	127	222,451

Zinc content of zinc pigments and salts produced by do by sources, in short ton

Pigment or salt	1937				
	Zinc in pigments and salts produced from—			Total zinc in pigments and salts	D
	Domestic ore	Slab zinc	Secondary material		
Zinc oxide	70,607	24,052	8,228	102,887	
Leaded zinc oxide	20,666	542	258	21,466	
Lithopone	[1] 19,244		13,040	[1] 32,284	
Zinc sulfide	(2)		(2)	(2)	
Zinc chloride	(2)	(2)	(2)	(2)	
Zinc sulfate	1,105		1,735	2,840	

[1] Revised figures. [2] Dat

PRODUCERS AND PLANTS

The following companies sold or used lead and zinc pigments and zinc salts of their own production in 1938:

White lead:	
The Eagle-Picher Lead Co	Cincinnati, Ohio.
Euston Lead Co	Scranton, Pa.
W. P. Fuller & Co	South San Francisco, Calif.
International Smelting and Refining Co. (electrolytic process).	East Chicago, Ind.
John T. Lewis & Bros. Co	Philadelphia, Pa.
National Lead Co	Melrose, Calif.
Do. (2 plants)	Chicago, Ill.
Do	St. Louis, Mo.
Do	Perth Amboy, N. J.
Do	Brooklyn, N. Y.
Do	Port Richmond, N. Y.
The Sherwin-Williams Co	Chicago, Ill.
Basic lead sulfate, or sublimed lead:	
The Eagle-Picher Mining & Smelting Co	Galena, Kans.
National Lead Co	St. Louis, Mo.
Red lead, orange mineral, and litharge:	
The Andrews Lead Co., Inc	Long Island City, N. Y.
E. I. du Pont de Nemours and Co	East Chicago, Ind.
The Eagle-Picher Lead Co	Joplin, Mo.
Do	Newark, N. J.
The Eagle-Picher Mining & Smelting Co	Galena, Kans.
W. P. Fuller & Co	South San Francisco, Calif.
Hammond Lead Products, Inc	Hammond, Ind.
Morris P. Kirk & Son	Los Angeles, Calif.
John T. Lewis & Bros. Co	Philadelphia, Pa.
Metals Refining Division of the Gidden Co.	Hammond, Ind.
National Lead Co	Melrose, Calif.
Do	Chicago, Ill.
Do	St. Louis, Mo.
Do	Brooklyn, N. Y.
Do	Charleston, W. Va.
The Sherwin-Williams Co	Chicago, Ill.
United Color & Pigment Co	Newark, N. J.
Zinc oxide and leaded zinc oxide:	
American Zinc Co. of Illinois	Hillsboro, Ill.
American Zinc Oxide Co	Columbus, Ohio.
The Eagle-Picher Lead Co	Hillsboro, Ill.
International Smelting and Refining Co. (French process).	East Chicago, Ind.
Do	Akron, Ohio.
Morris P. Kirk & Son	Los Angeles, Calif.
Monsanto Chemical Co	St. Louis, Mo.
The New Jersey Zinc Co. (of Pennsylvania)	Palmerton, Pa.
Do. (French process)	Freemansburg, Pa.
The Ozark Smelting & Mining Division of The Sherwin-Williams Co.	Coffeyville, Kans.
Röhm & Haas Co	Bristol, Pa.
St. Joseph Lead Co. of Pennsylvania	Monaca, Pa.
Superior Zinc Corp	Bristol, Pa.
Lithopone:	
The Chemical & Pigment Co	Oakland, Calif.
Do	Collinsville, Ill.
Do	St. Helena, Md.
E. I. du Pont de Nemours and Co	Newport, Del.
Do	Newark, N. J.

Lithopone—Continued.	
The Eagle-Picher Lead Co	
Mineral Point Zinc Division of The New Jersey Zinc Co	
The New Jersey Zinc Co. (of Pennsylvania)	
The Ozark Smelting & Mining Division of The Sherwin-Williams Co	
The Sherwin-Williams Co	
United Color & Pigment Co	
Zinc sulfide:	
American Zinc Oxide Co	
Mineral Point Zinc Division of The New Jersey Zinc Co	
The New Jersey Zinc Co. (of Pennsylvania)	
The Ozark Smelting & Mining Division of The Sherwin-Williams Co	
Zinc salts:	
American Smelting and Refining Co	
Do	
Do	
Do	
Do	
Atlas Powder Co	
The Chemical & Pigment Co	
Charles Cooper & Co., Inc	
E. I. du Pont de Nemours and Co	
Do	
Do	
General Chemical Co	
Great Western Electro-Chemical Co	
Jordan Co	
Morris P. Kirk & Son	
Mallinckrodt Chemical Works	
Merrimac Division of Monsanto Chemical Co.	
The Ozark Smelting & Mining Division of The Sherwin-Williams Co	
Pacific Smelting Inc., Ltd	
Röhm & Haas Co	
The Ruby Chemical Co	
Virginia Smelting Co	

PRICES

The total values reported by producers f
and zinc salts are given in the tables in th
The average values received for importan
from 11 to 15 percent, while those for zinc
stationary or increased up to 14 percent.
tations, as reported by the Oil, Paint, and
in the following table. The prices for lead
lowed that for pig lead, declining to the lo
middle of the year and rising in the third
for lithopone, zinc chloride, and zinc sul
changed from those for 1937, while prices
remained throughout the year at the best le

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1935–38, in cents per pound

Product	1935	1936	1937	1938
Basic lead sulfate, or sublimed lead, less than carlots, barrels	6.25	6.25–6.75	6.50–8.75	5.50–6.50
White lead, or basic lead carbonate, dry, carlots, barrels	6.50	6.50–7.25	6.75–9.00	6.00–7.00
Litharge, commercial, powdered, barrels	6.00–7.00	6.00–8.50	6.25–10.00	5.50–7.50
Red lead, dry, 95 percent or less, less than carlots, barrels	7.00–8.00	7.50–9.50	7.75–11.00	7.00–8.50
Orange mineral, American, small lots, barrels:				
Ex-white lead	9.50–11.00	10.50–11.25	10.25–13.50	9.50–11.00
Ex-red lead	9.00–10.50	10.50–11.25		
Zinc oxide:				
American process, lead-free, bags, carlots	5.00–6.50	5.00–5.25	5.25–7.50	6.25–7.50
American process, 5 to 35 percent lead, barrels, carlots	5.13–6.50	5.13–5.38	5.38–6.88	5.90–6.38
French process, red seal, bags, carlots	5.50–8.38	5.50–5.75	5.75–7.50	7.50
French process, green seal, bags, carlots	6.00–9.38	6.00–6.25	6.25–8.00	8.00
French process, white seal, barrels, carlots	6.50–10.63	6.50–6.75	7.00–8.75	8.75
Lithopone, *domestic*, 5-ton lots, bags	4.50	4.25–4.50	4.25–4.63	4.38–4.63
Zinc sulfide, less than carlots, bags, barrels	10.50–11.75	9.25–11.75	9.25–9.50	8.63–9.50
Zinc chloride, works:				
Solution, tanks	2.00	2.00	2.00–2.25	2.25
Fused, drums	4.50–5.75	4.25–5.75	4.25–5.75	4.25–5.75
Zinc sulfate, *crystals, barrels*	2.65–2.80	2.65–3.05	2.80–4.05	2.65–4.05

FOREIGN TRADE [6]

Imports of lead and zinc pigments decreased 32 percent and exports 29 percent in value in 1938. The excess value of exports over imports amounted to $554,000; it was only slightly more than one-fifth of the annual average for 1925–29. The value of imports of lead and zinc salts was less than one-half that in 1937, while the value of exports of lead arsenate, the only salt separately recorded, increased.

The following table shows the values of various pigments and salts imported and exported in 1937 and 1938.

Value of foreign trade of the United States in lead and zinc pigments and salts, 1937–38

	1937		1938	
	Imports	Exports	Imports	Exports
Lead pigments:				
White lead	$6,677	$207,381	$3,979	$190,745
Red lead	285	158,923	79	115,343
Litharge	31	220,134	123	203,610
Orange mineral	928	(1)	271	(1)
Other lead pigments	9,406	(1)	5,533	(1)
	17,327	586,438	9,985	509,708
Zinc pigments:				
Zinc oxide	97,686	378,332	73,487	185,848
Lithopone	302,417	231,622	207,115	153,562
Zinc sulfide	13,856	(1)	4,798	(1)
	413,959	609,954	285,400	339,410
Lead and zinc salts:				
Lead arsenate	42	91,377		95,198
Other lead compounds	36,615	(1)	12,059	(1)
Zinc chloride	44,101	(1)	19,718	(1)
Zinc sulfate	29,966	(1)	16,321	(1)
	110,814	91,377	48,698	95,198
Grand total	542,100	1,287,769	344,083	944,316

[1] Data not available.

[6] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Lead pigments and salts.—Imports of thes
icant. The most important item is the g
which include lead acetate, lead nitrate, a
these compounds fell from 213 tons in 193
of suboxide of lead fell from 28 tons in 193

Lead pigments and salts imported for consumption in short tons

Year	Basic carbonate white lead	Red lead	Litharg
1934	15		(1)
1935	6	1	
1936	32	2	
1937	34	1	(1)
1938	20	1	

[1] Less than 1 ton.

[2] Includes also—1934: Lead *pigments, n. s. p. f.*, $18 (200 pou
(210 pounds); 1935: Lead pigments, n. s. p. f., $478 (4,405 pounds);
pounds), sublimed lead (basic sulfate) $9 (15 pounds), and suboxide o
1937: Lead pigments, n. s. p. f., $8 (100 pounds), sublimed lead (basic
of lead, n. s. p. f., $9,396 (55,453 pounds); 1938: Lead pigments, n. s.
of lead, n. s. p. f., $5,235 (31,834 pounds).

The principal exports are white lead an
items increased in 1938, although not sign
lead and lead arsenate declined in 1938. I
lead, and litharge comprised less than 2
duction of these pigments.

White lead was exported principally to
Netherlands, and Canada, while red lead a
mainly to Canada, the Philippines, and Ne

Lead pigments and salts exported from the United

Year	White lead	Red lead
1934	1,561	745
1935	2,337	750
1936	1,862	810
1937	1,236	934
1938	1,411	806

*White lead, red lead, and litharge exported from th
destinations, in short ton*

Destination	White lead			
	1935	1936	1937	19
Countries:				
Argentina	98	120	80	
Canada	56	74	126	
Netherlands	827	387	83	
Netherland West Indies	3	3	5	
Panama	205	453	206	
Philippine Islands	190	170	272	
United Kingdom	93	13	23	
Others	865	636	432	
	2,337	1,862	1,236	1,
Continents:				
North America	441	754	479	
South America	202	218	170	
Europe	1,242	707	232	
Asia	285	174	336	
Africa	166	9	18	
Oceania	1	(1)	1	(1)

[1] Less than 1 ton.

Zinc pigments and salts.—Imports of all items shown under this heading declined in 1938. Lithopone ranks as the most important zinc pigment imported, although imports of this commodity represented only 3 percent of domestic sales in 1938. Imports of zinc oxide (dry and in oil) totaled 645 tons, a decline from 775 tons in 1937.

Zinc pigments and salts imported for consumption in the United States, 1934–38, in short tons

Year	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	Total value
	Dry	In oil					
1934	1,204	64	3,027	12	382	140	$404,258
1935	1,932	59	4,603	16	564	135	508,478
1936	694	96	4,781	30	620	385	425,493
1937	680	95	5,601	113	667	503	488,116
1938	579	66	3,932	12	272	392	321,439

Exports of zinc oxide made a notable gain in 1937 but in 1938 returned to 13 percent below the 1936 level. Shipments of lithopone abroad declined sharply in 1938 and were the smallest recorded since 1933. As usual, Canada was the principal destination of exports of zinc oxide and lithopone, 514 and 1,219 tons, respectively, of the totals of 1,163 and 1,734 tons going to that country in 1938.

Zinc pigments and salts [1] exported from the United States, 1934–38, in short tons

Year	Zinc oxide	Lithopone	Total value	Year	Zinc oxide	Lithopone	Total value
1934	1,155	2,401	$395,189	1937	2,953	2,671	$609,984
1935	1,140	2,372	392,368	1938	1,163	1,734	339,415
1936	1,330	2,638	419,987				

[1] Zinc salts not separately recorded.

Zinc oxide and lithopone exported from the United States, 1935–38, by destinations, in short tons

Destination	Zinc oxide				Lithophone			
	1935	1936	1937	1938	1935	1936	1937	1938
Countries:								
Argentina	35	55	48	86	74	35	63	
Canada	453	704	1,583	514	1,652	1,812	1,740	1,219
Cuba	115	80	207	48	108	180	258	
France	15	13	111	49	2	3	1	
United Kingdom	50	80	29	26	138	199	199	
Others	466	398	975	440	308	303	410	
	1,140	1,330	2,953	1,163	2,372	2,638	2,671	1,734
Continents:								
North America	724	882	1,072	669	1,060	2,104	2,184	
South America	78	130	140	117	118	67	90	
Europe	94	99	148	85	140	218	217	
Asia	132	52	467	159	16	25	24	
Africa	5	6	57	3	3	4	1	
Oceania	107	161	160	140	126	130	155	

GOLD, SILVER, COPPER, AND

(MINE REPORT)

By CHAS. W. HENDE

SUMMARY OUTL

	Page	
Summary	185	Markets
Calculation of value of metal production	185	Review b

Alaska mines yielded gold, silver, copp of recovered metals at $26,527,315 in 1938 in 1937, a decrease of less than 0.5 percen gross production in 1938 comparable w directly to a 9-percent increase in value production from lode mines remained virt 2 years. The value of the copper output 1937, owing to exhaustion of the ore bodi producers and to the lower average price

All tonnage figures are short tons and do not include moisture.

The value of metal production herein re at the following prices.

Prices of gold, silver, copper, lead, a

Year	Gold [1]	Silver
	Per fine ounce	*Per fi ounce*
1934	$34.95	[4] $0.64
1935	35.00	.718
1936	35.00	.774
1937	35.00	.773
1938	35.00	[4] .64

[1] 1934: Yearly average weighted Government price; 1935–38: P Jan. 31, 1934. Treasury legal coinage value of gold from Jan $20.671835) per fine ounce.
[2] 1934 and 1938: Treasury buying price for newly mined silver; 19 ying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal s
[4] $0.64646464.

The following tables show the mine prod per, and lead in Alaska in 1934–38 and 188 ilver, and lead from amalgamation and ithout concentration equipment) in 1938 ut of gold and silver in 1938, by types of Mines is not at liberty to publish separately straight concentration mills and that shi

iger life to current-carrying or heat-carrying members of electrical chinery. Besides its high electric and thermal conductivity, this w alloy is unusually resistant to corrosion by a wide variety of ses and liquids, according to Business Week (December 24, 1938, 27).

At the close of 1938 sodium uranate, Na_2UO_4, was quoted at $1.75 $1.80 per pound for either the yellow or orange variety; uranium ide, 96 percent U_3O_8, in 100-pound lots at $2.65 to $2.75 a pound for black and $1.75 to $1.80 for the yellow or orange product.

RARE EARTHS

The rare earths continue to command the attention of numerous earch workers, although commercial developments are impeded by ir high price. Paradoxically, the rare-earth metals are not remely rare in nature. But they are difficult to separate, and ny of their potential uses can be satisfied by cheaper elements. oxides of cerium are used in ceramics and special glasses. A good mé of the use of rare earths in the glass industry was published [21] ntly, and another paper [22] calls attention to the availability of thanum as a byproduct of recovering thoria and ceria from monaand its potential applications in the ceramic and glass industries, weighting silk, as a catalyst, and as a constituent of alloys. Ceric le is one of the best opacifiers [23] for enamels, yet it is seldom used in Europe.

eodymium and praseodymium [24] occur in all cerium minerals in a o of at least two parts neodymium to one part prascodymium. ently neodymium (which stains glass violet) has been applied essfully as a physical decolorizer for glass. Didymium, a mixture eodymium and praseodymium, gives a neutral-gray glass.

s an illustration of the wide distribution of the rare earths, the eau of Chemistry and Soils in cooperation with the National eau of Standards has recently identified substantial traces of rareh metals in the ashes of many plants. The rare-earth concentrate hickory leaves grown in a pegmatite vein amounted to 0.2 per- of the dry weight of the leaf.

he Glass Industry (January 1939 issue) quoted cerium hydrate pound drums and 600-pound barrels) at 60 cents a pound, ymium oxalate (50-pound drums) at $3.50 a pound, and "rare- hydrate" at 30 cents (325-pound barrels) to 35 cents (100-pound s) a pound.

SELENIUM AND TELLURIUM

ore and more selenium is being recovered from copper refining; as the use of selenium in glass no longer seems to be increasing, earch for new uses has been resumed. The demand for tellurium ll much less than that for selenium and only a fraction of the tity that could be recovered if byproduct sources were fully ed. Tellurium is used to increase the toughness and resistance

[21] oky, V., Importance of Rare Earths for the Glass Industry: Sklarske Rozhledy, vol. 15, 1938, ; Ceram. Abs., vol. 17, No. 8, August 1938, p. 274.
[22] it, E., and Pütter, K. E., Importance of Lanthanum as a Raw Material: Angew. Chem., vol. 51, 463–464; Jour. Soc. Chem. Ind., London, vol. 57, No. 9, September 1938; British Chem. Abs., B,
[23] bert, C. J., Less Familiar Elements in Ceramic Pigments: Ind. and Eng. Chem., Ind. Ed., vol. 30, ly 1938, pp. 770–772.
[24] atwalla, B. D., Rare Metals and Minerals: Min. and Met., vol. 20, No. 385, January 1939, p. 11.

to abrasion of rubber hose and cable coverings. Inc of tellurium lead are being marketed, but this outlet is as it takes only a few hundredths of 1 percent of tellu toughen, and increase the corrosion resistance of ordina ing to a report of the International Tin Research an Council (Pub. 81) tellurium also improves remark hardening properties and creep strength of tin; in qua percent it improves somewhat the tensile strength Industrial hazards from selenium and its toxicity are recent Government report.[25] Further research indica effects of selenium in soils have been greatly exagge some plants seem to be stimulated by selenium, and ally need it to thrive.[27]

Prices of selenium (black, powdered, 99.5 percent) ally unchanged in 1938 at $1.75 to $1.85 a pound in rose slightly to 7s. 3d. in London. Barium selen quoted in domestic glass-trade journals at $1.40 to while the quotation for the "commercial" grade (25 mains at 85 cents. Sodium selenite, Na_2SeO_3, which glassmaking, is quoted at $1.50 to $1.65 a pound in 1 quotations of $2 a pound for tellurium have remaine several years, and London trade journals continue to at 7s.

Production, sales, and imports of selenium and production and the United States, 1934–38

Year	Selenium			
	Production (pounds)	Sales [1] (pounds)	Imports	
			Pounds	Value
1934	254,394	319,838	17,719	$24,591
1935	244,710	232,831	179,331	322,332
1936	352,480	226,402	122,806	215,835
1937	435,821	282,508	92,523	161,382
1938	225,874	166,404	101,034	163,508

[1] Bureau of Mines not at liberty to publish value.

TITANIUM

Because of their great whitening and obliterating pigments continue to be employed widely in paint, leather, plastics, soap, printing inks, paper, textile In addition to the well-known white pigments an yellow pigment has recently been developed that co and antimony as well as titanium dioxide. Ilmenite making titanium pigments and to a smaller extent alloys, is produced in the United States in Virgini California, but the main supply is imported from far the world's largest producer. Rutile is produce both for domestic consumption and for export and

[25] Dudley, H. C., Selenium as a Potential Industrial Hazard: U. S. Public 281–292.
[26] Lakin, H. W., Williams, K. T., and Byers, H. G., "Nontoxic" Seleniferous S Ind. Ed., vol. 30, No. 5, May 1938, pp. 599–600.
[27] Trelease, Sam, and Helen M., Selenium as a Stimulating and Possibly Ess Plants: Science, vol. 87, No. 2247, 1938, pp. 70–71.

from Brazil and Australia. Deposits are being opened up in various other countries. The principal uses of rutile are in welding-rod coatings and ceramics; the former recently has become the most important outlet, consuming as much as 1,200 to 2,500 tons a year.[28]

The Bureau of Mines is not at liberty to publish figures of domestic production of ilmenite and rutile. Imports of rutile declined to 130 short tons valued at $26,533 in 1938 compared with 665 tons and a value of $67,643 in 1937. Those of ilmenite continued their phenomenal expansion, reaching 201,545 long tons valued at $1,018,430 compared with the previous record of 153,993 tons valued at $770,757 in 1937.

The rapid growth of the titanium industry and the increasing variety of uses for the element in its sundry products have been reviewed in previous volumes of Minerals Yearbook and are not repeated in this chapter. During 1938 ilmenite was discovered in Natal, payable quantities being reported in sand dredged from Durban Bay. In southern Egypt the Hamata Mining Co., already engaged in mining manganese, installed equipment for producing ilmenite. Rutile, which has been mined sporadically in French Cameroons in Africa, may be mined more systematically following the gradual acquisition of mining rights in the numerous areas. Rutile has been produced extensively in Australia from beach sands at Byron Bay and elsewhere in New South Wales where it occurs with zircon. Deposits of this mineral in South Australia were visited in 1937 by the Government Inspector of Mines, who cautioned against premature expansion of the existing pilot plant which can treat a maximum of 2 tons of crushed ore, equivalent to about 180 pounds of 80 percent concentrate, daily.[29] In South Africa the property in Omaruru that produced over 16 tons of rutile from a high-grade deposit (4 to 20 percent TiO_2) was idle in 1938, having been optioned to an overseas firm according to a Government report. The Dominion Bureau of Statistics (Ottawa) reveals a sharp increase in production of titanium ore in Canada to 4,229 short tons valued at $26,432 in 1937, with a drop to 207 tons worth $1, 449 in 1938. The entire output was shipped from St. Urbain, Quebec, to ferro-alloy manufacturers. In France titanium, as well as vanadium and zircon, may be recoverable from "red mud" from bauxite refining.

A new titanium mineral, $FeTiO_3.Fe_3O_4.TiO_2$, is reported[30] from Nellore, India.

Engineering and Mining Journal quotations for titanium ore in 1938 were: Ilmenite, 45 to 55 percent TiO_2, f. o. b. Atlantic seaboard, $10 to $12 per gross ton according to grade and impurities; rutile, guaranteed minimum 94 percent concentrate, 10 cents per pound (nominal); 88 to 90 percent, $55 per ton, c. i. f. New York; ferro-carbon-titanium, $142.50 per short ton f. o. b. producer's plant. The price of titanium dioxide was reduced 1 cent at the end of the year to 14 and 14½ cents a pound (carloads). Phthalate-treated pigment was quoted at 22 to 22½ cents per pound with extras for smaller quantities.

[28] Saklatwalla, B. D., Rare Metals and Minerals: Min. and Met., vol. 20, No. 385, January 1939, p. 12.
[29] Imperial Institute (London), South Australian Rutile: Bull., vol. 36, January-March 1938, p. 78.
[30] Jayaraman, N., and Krishnaswami, K. R., Chemical and Mineralogical Study of a New Titanium Mineral from Nellore: Proc. Indian Sci. Cong., 25th Cong., 1938, pt. 3, p. 117; Ceram. Abs., vol. 17, No. 7, July 1938, p. 261.

ZIRCONIUM

Australia, India, and Brazil still supply t
zircon, and Brazil is the only source of badd
present in concentrates and black sands fron
mining. It was recovered in commercial qua
in 1937 in the sluice boxes of the Kaufield
Lincoln, Placer County, Calif. Exact figure
this appears to be the first domestic productio
tions at Pablo Beach, Fla., ceased.

The rise to importance of zirconium duri
century and the many uses of the metal and it
have been discussed in previous volumes of
are covered more fully in recent papers p
Mineral Co.[31] An even more comprehensive
foreign trade journal.[32]

According to Saklatwalla[33] copper conta
zirconium metal yields an alloy comparable
new alloy, Silvaz, containing 6 to 6.5 percent
veloped as a steel refiner. It also contains
aluminum and vanadium and about 40 perce
This alloy is claimed to produce better resul
separate additions of the respective alloys,
and Izod impact ductility. One new use f
manufacture of molds for cast steel, and anot
electric heating devices.

Zirconium metal is used in radio tubes (wi
cups (sheet). Zirconium-silicon and zirco
are used in steel making, whereas the powder
light mixtures and ammunition primers. Ev
requirements for such purposes are small, an
in the form of compounds for use in ceramics a
The main consumption is in enamel and glaz
only zirconium oxide but also zircon and sodi

Engineering and Mining Journal quotat
nominal: Zircon ore, 55 percent ZrO_2, f. o. b. A
lots, $55; 5-ton lots, $60 per short ton; cru
f. o. b. Suspension Bridge, New York, milled,

[31] Meyer, H. C., Economics of Some of the Less Familiar Element
30, No. 4, April 1938, pp. 431–436.
Fast, J. D., Zirconium: Foote-Prints, vol. 10, Philadelphia, Dece
Preston, E., Zirconia in Glass: Foote-Prints, vol. 11, Philadelphia
[32] Esme, A., Zirconium Compounds and their Application in the
Argile, No. 178, 1938, pp. 11–15; No. 179, pp. 21–23; No. 181, pp. 18–23.
1938, p. 341.
[33] Saklatwalla, B. D., Rare Metals and Minerals: Min. and Met.,