U.S. DEPARTMENT O
HAROLD L. ICKE
BUREAU OF
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MINERALS Y

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UNITED S
GOVERNMENT PR
WASHINGT

For sale by the Superintendent

LEAD

By Elmer W. Pehrson and

SUMMARY OUTL

The lead industry of the United States
Although the New York price averaged
consumption was 10 percent higher, ref
lead declined 5 percent to the lowest
increased 15 percent to a new high. A
year was the large supply of secondary
increased 13 percent compared with an
the output of primary domestic lead. F
did not share in the increased market fo
secondary producers. Recovery of seco
equivalent to 86 percent of the domes
compared with 42 percent during the 5
duction at the mines decreased 7 percent
Figure 4 shows trends in the United
years.

During the first 3 months of 1933 don
low level of 19,500 tons per month com
in 1929. As production exceeded con
rapidly; yet in spite of this unsatisfac
price held at 3 cents throughout Januar
the inauguration of the new administra
advanced on a short buying wave, but
again settled to 3 cents. However, as th
economic recovery was revealed, consu
anticipation of higher prices. This move
by the announcement of curtailment in
ducer and by the abandonment of the go
July domestic shipments exceeded 45,000
October 1930. As production failed to
stocks fell rapidly and prices soared, re
which held from early in July to the mid

In the latter part of the year the demand slackened, and by September shipments had declined to less than 30,000 tons. The higher price level had by this time stimulated production at the mines. Stocks again began to rise and at the end of the year amounted to 203,000 tons, 15 percent higher than at the beginning of the year. The quotation on December 30, 1933, was 4.15 cents; the average for the year was 3.87 cents.

Outside the United States improvement in the lead industry was more pronounced. Production increased 1 percent, and as consump-

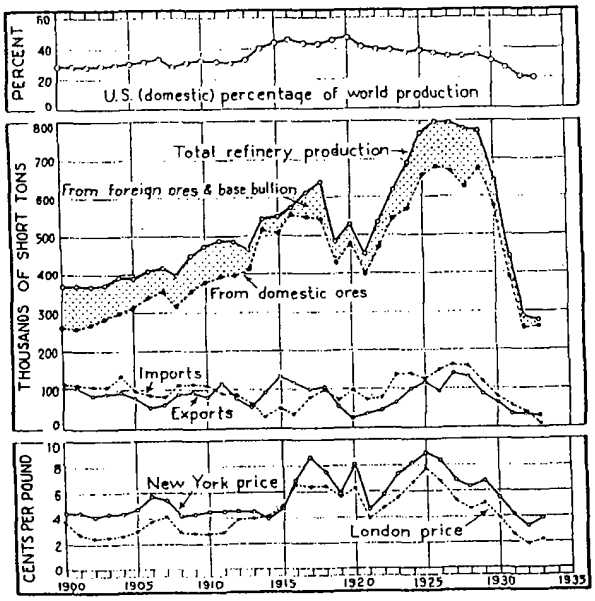

FIGURE 4.—Trends in the United States lead industry, 1900–33. Imports include general imports of lead in ore, base bullion, and refined; exports include refined lead and lead exported in manufactures with benefit of drawback.

tion reached a higher level than in 1932 stocks decreased slightly. The London price averaged 2.21 cents per pound (United States exchange basis), an increase of 19 percent over 1932. No attempt was made to revive the International Association of Lead Producers during the year, but exchange of statistics was continued by voluntary cooperation of the various members.

The following table compares the lead industry of the United States during the past 4 years with the 5-year average for 1925–29.

Salient statistics of the lead industry i

	1925–29 average	
Production of refined primary lead:		
From domestic ores ... short tons	660, 525	
From foreign ores and base bullion ... short tons	123, 104	
	783, 629	
Recovery of secondary lead:		
As pig lead ... do	126, 600	
In alloys ... do	153, 400	
	280, 000	
Total production of pig lead (primary and secondary) ... short tons	910, 229	
Imports (general):		
Lead in base bullion ... do	95, 747	
Lead in ore ... do	40, 096	
Exports of refined pig lead ... do	98, 048	
Refined primary lead available for consumption ... short tons	677, 322	
Estimated consumption of primary and secondary lead ... short tons	900, 250	
Prices per pound of refined lead at New York:		
Highest monthly average ... cents	10. 33	
Lowest monthly average ... do	6. 02	
Average for year ... do	7. 47	
Quotation at end of year ... do	6. 25	
Mine production of recoverable lead ... short tons	661, 799	
Southeastern Missouri district ... percent of total	30	
Utah ... do	23	
Idaho ... do	21	
Joplin (Tri State) region ... do	13	
All other ... do	13	
World smelter production of lead ... metric tons	1, 678, 000	
United States ... percent of total	38	
Mexico ... do	12	
Australia ... do	10	
Canada ... do	7	
Spain ... do	9	
All other ... do	24	

[1] Subject to revision.

Lead industry and NRA.—The lead
President's Reemployment Agreement
pending preparation and approval of a
The first draft of a basic code was subr
hearings were held on December 22.
code was signed by the Administrator o
effective on June 4.

The code provides for a code author
committee of the Lead Industries Ass
association, and the chairmen of the
The latter include mining, smelting an
metal), lead pigments, metallic lead
products. Minimum wages and hours
and provision is made for establishing s
No definite control of production or s
set up, although provision is made that
mended. The code specifies trade-
pigments, metallic-lead-products, and r
There is no provision for price-fixing, b
for the lead pigments division provi
data and uniform bases for sale.

DOMESTIC PRODUCTION

Refined pig lead produced in the United States is derived from three main sources—domestic ore, foreign ore and base bullion, and secondary materials. The following table shows the production from each of these sources from 1924 to 1933.

Total pig lead produced in the United States, 1924–33, short tons

Year	From domestic ores and base bullion	From foreign ores and base bullion	From secondary materials	Total
1924	566,407	124,086	90,400	780,893
1925	651,921	112,018	112,120	876,389
1926	690,685	118,256	125,090	923,011
1927	668,320	128,210	119,000	915,530
1928	626,202	154,869	138,000	919,071
1929	672,498	102,135	138,500	913,133
1930	573,710	69,293	129,000	772,033
1931	390,260	52,501	128,800	571,564
1932	255,337	33,024	128,000	416,361
1933	259,616	13,963	131,800	405,379

PRIMARY LEAD

Refinery production.—Production of refined primary lead in 1933 declined 5 percent and was the lowest recorded since 1886. Production from foreign ores and base bullion declined 58 percent and was the lowest since 1886, the first year in which lead production from foreign raw materials was reported. Lead derived from domestic ores increased 2 percent in 1933.

Refined primary lead produced in the United States, 1929–33

Year	Production (short tons)				Sources (short tons)			Value	
	Desilverized lead [1] [2]	Desilverized soft lead	Soft lead [2]	Total production [1]	From domestic ores and base bullion	From foreign ores	From foreign base bullion	Average per pound	Total
1929	483,622	55,666	235,345	774,633	672,498	29,675	72,460	$0.063	$97,691,000
1930	390,094	45,578	201,361	643,033	573,710	34,348	34,915	.050	64,303,000
1931	263,910	40,456	138,389	442,755	390,260	22,251	30,250	.037	32,765,000
1932	189,707	35,524	63,130	288,361	255,337	21,747	11,277	.030	17,302,000
1933	165,791	22,210	85,578	273,579	259,616	7,677	6,286	.037	20,215,000

[1] The lead content of antimonial lead is excluded (see p. 84).
[2] Desilverized soft lead is excluded.

Source of primary lead.—Of the total refined lead produced in 1933, 94.9 percent was derived from domestic ores, 2.8 percent from foreign ores, and 2.3 percent from foreign base bullion. Production from foreign ores declined 65 percent in 1933 owing to reduced tonnages from Newfoundland (included as "other foreign" in the following table), Europe (mostly Sweden), and South America. Smelting of Canadian ores was fairly well maintained in 1933; but Mexican ores, which in 1924 yielded over 33,000 tons of lead, have contributed only negligible amounts during the past 2 years. The production of refined lead from foreign base bullion declined 44 percent in 1933.

During the past 3 years virtually all
the United States has come from M
of lead derived from domestic ores ar
production.

Refined primary lead produced in the Uni
short ton

Source	
Domestic ore	07
Foreign ore:	
Australia	
Canada	
Europe	
Mexico	1
South America	
Other foreign	
	2
Foreign base bullion:	
Mexico	5
South America	2
	7
Total foreign	10
Grand total	77

Soft lead.—Nonargentiferous lead c
a soft lead can be produced without
known as soft-lead ores. Most of th
United States are smelted into pig le
is used each year in the manufactur
basic lead sulphate (white sublimed
About one-fifth of the pig lead prod
silverized and used largely in the manu
purity is required. Undesilverized
high copper is extremely resistant to c
to the trade as chemical lead; it is u
of cable, pipe, and sheets.

The following table gives the proc
past 5 years:

Soft lead produced in the United States from

Year	Soft pig lead		T
	Undesilverized	Desilverized	
1929	235,345	55,666	29
1930	201,361	45,578	24
1931	138,389	40,456	17
1932	63,130	35,524	9
1933	85,578	22,210	10

[1] Includes domestic refined lead, domestic lead in antim
mestic lead in antimonial lead computed on different basis

Antimonial lead.—Antimonial lead
byproduct of the refining of base bu

from this source is only a small part of the country's yearly production. The principal uses of hard lead are in the manufacture of storage batteries, bearing metals, corrosion-resistant alloys, and type metal. A large percentage of the metal so used returns as scrap when the products have become worn out or obsolete. The smelting of such scrap yields the major part of the antimonial lead used, the remainder being supplied by the refining of base bullion and by mixing metallic antimony with refined soft lead.

Several lead-smelting plants operate on scrap materials exclusively. Production data from such plants are summarized in the chapter on Secondary Metals. A large quantity of hard lead scrap is also treated at primary smelters and refineries, and the production of antimonial lead at these plants is shown in the table that follows.

Antimonial lead produced at primary lead refineries, 1929–33

Year	Production (short tons)				Antimony content		Lead content by difference (short tons)			
	From domestic ore	From foreign ore	From scrap	Total	Short tons	Percentage	From domestic ore	From foreign ore	From scrap	Total
1929	17,062	8,607	17,575	43,244	4,035	11.4	(1)	(1)	(1)	38,309
1930	8,918	4,703	11,086	24,707	2,967	12.0	(1)	(1)	(1)	21,830
1931	(2)	(2)	(2)	21,842	2,438	11.2	3,628	1,693	14,173	19,494
1932	(2)	(2)	(2)	21,024	2,495	11.9	3,577	1,466	13,480	18,520
1933	(2)	(2)	(2)	17,805	1,720	9.7	4,158	791	11,136	16,085

[1] Not recorded.
[2] Segregation discontinued.

SECONDARY LEAD

Production of secondary lead has held up relatively much better than primary lead during the depression. In 1933 it amounted to 80 percent of the 5-year average 1925–29, whereas production of primary lead from domestic ores was only 39 percent. As a result of these divergent trends the output of secondary lead was equivalent to 86 percent of the domestic primary output in 1933 compared to 42 percent for the 5-year period.

Many of the lead-consuming industries, such as those making storage batteries and cable coverings and the building industry, provide a large return of secondary metal. It has been estimated that as much as 90 percent of the lead used in the manufacture of storage batteries is returned to the smelters. Although there has been a marked decline in the manufacture of new automobiles the total number of cars in operation has declined only about 10 percent, and the replacement of batteries in old cars has been largely responsible for the maintenance of the scrap supply for secondary smelting. Storage-battery scrap accounts for about half of the secondary lead production. Another factor of some importance in maintaining the supply of scrap has been the salvaging of materials in manufacturing plants that have failed during the depression.

The large proportion of secondary lead consumed during the last few years has added to the hardships of primary producers and the lead-mining communities. It should be borne in mind, however, that when consumption again expands the increase will be supplied largely

by primary metal and that the ratio of s
tion will probably return to the predep
years may be below that average.

Secondary lead recovered in the U

Year	Pig lead (short tons)—			L
	At primary plants	At secondary plants	Total	
1929	65,359	73,141	138,500	
1930	48,135	80,865	120,000	
1931	43,774	85,026	128,800	
1932	33,611	94,389	128,000	
1933	41,632	90,168	131,800	

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

LEAD PIGMEN

Lead pigments manufactured in 1933
from the sources shown in the followir
143,027 tons were derived from refined p
for 42 percent; litharge, 40 percent; red
lead and orange mineral, 4 percent. S
oxide are the principal pigments in whi
from ores.

Lead in pigments,[1] 1929–33, by

Year	Lead in pigments from—				Y
	Domestic ore [2]	Metal	Scrap	Total	
1929	9,429	248,657	2,427	260,513	1932
1930	6,686	190,182	689	197,557	1933
1931	5,722	166,328	710	172,760	

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

Further details on the production of
chapter on Lead and Zinc Pigments an

MINE PRODUCT

Mine production of recoverable lead
tons, a decrease of 7 percent from 1932
age for 1925 to 1929. In the Western
increased 4 percent but that in the Cent
19 and 30 percent, respectively.

Compared with the 5-year average (
was as follows: Western States, 43 perce
and Eastern States, about 76 percent.
first in production but recorded a large

curtailment of operations in the southeast district. Idaho, with a 3-percent increase, again ranked second, and Utah continued to rank third, although its output declined 7 percent in 1933. These 3 States accounted for 80 percent of the total production. Oklahoma ranked fourth and increased its output 70 percent.

The decline in lead production during the depression has been severe in all the principal producing States. Idaho more nearly maintained its production than any other important State, yet its 1933 output was only 53 percent of the predepression average. The output of Missouri was only 42 percent; Utah, 39 percent; Montana, 36 percent; Oklahoma, 31 percent; Kansas, 23 percent; and Colorado, 8 percent. These 7 States contributed 92 percent of the lead produced from 1925 to 1929.

Mine production of recoverable lead in the United States, 1925–33, in short tons

State	1925–29 average	1930	1931	1932	1933
Western States and Alaska:					
Alaska	982	1,305	1,661	1,261	[1] 1,520
Arizona	9,743	4,246	982	1,182	[1] 1,600
California	2,070	1,780	1,879	1,209	[1] 375
Colorado	30,112	22,130	6,884	2,150	2,402
Idaho	141,610	134,058	99,365	72,118	[1] 74,375
Montana	18,871	10,053	4,430	1,079	[1] 6,700
Nevada	9,807	11,520	7,930	440	[1] 2,320
New Mexico	6,730	10,378	11,209	10,114	11,043
Oregon	6	5	2	4	5
South Dakota	21			4	22
Texas	213	198		17	3
Utah	149,509	115,495	79,212	62,776	58,088
Washington	1,323	576	1,380	921	840
Wyoming				5	
	370,997	312,413	215,000	153,280	[1] 159,980
Central States:					
Arkansas	38	53	78	4	10
Illinois	552	248	205	31	240
Kansas	26,121	12,910	7,082	6,490	6,089
Kentucky	135	101			176
Missouri	202,240	199,632	160,121	117,159	84,980
Oklahoma	58,306	23,052	13,210	10,634	18,038
Wisconsin	1,745	1,537	952	910	540
	280,137	237,533	181,648	135,228	110,073
Eastern States:					
New York					
Tennessee	4,096	8,307	7,974	4,460	3,116
Virginia					
	4,096	8,307	7,974	4,460	3,116
	664,230	558,313	404,622	292,968	[1] 273,170

[1] Subject to revision.

Mine production of recoverable lead in the prin United States, 1929–33,

District	State	19
Southeastern Missouri region	Missouri	197
Coeur d'Alene region	Idaho	141
Bingham	Utah	40
Joplin region	Kansas, Missouri, Oklahoma	74
Park City region	Utah	42
Willow Creek	New Mexico	5
Rush Valley	Utah	11
Tintic	do	44
Butte	Montana	8
Central	New Mexico	3
Eagle	Montana	
San Juan Mountains	Colorado	17
Metaline	Washington	
Pend d'Oreille	Idaho	
Upper Mississippi Valley	Iowa, Northern Illinois, Wisconsin.	1
Leadville	Colorado	5
Inyo County	California	
Bisbee (Warren)	Arizona	1
Eagle County	Colorado	
Cedar Plains	Montana	1
Dome	Idaho	1
Tybo	Nevada	1
San Francisco	Utah	
Warm Springs	Idaho	1
Barker	Montana	(
Banner	Arizona	2
Austinville [3]	Virginia	(
Jack Rabbit [3]	Nevada	2
Oro Blanco [3]	Arizona	(
Ploche [3]	Nevada	2
St. Lawrence County [3]	New York	

[1] Subject to revision.
[2] Data not available.
[3] Not listed according to rank.
[4] Bureau of Mines not at liberty to publish figures.

STOCKS

Lead stocks, as reported by the Am
tistics, are shown in the following table
monial lead include metal held by all
the refiners of secondary material that
eign lead refined in the United States
sumption is included. During the pas
lead have increased steadily. At the c
five times the amount held at the close
refined and antimonial lead on Decem
7-month supply at the average rate
50,000 tons are allowed as normal stoc
at the end of 1933 were equivalent to
tion. Stocks of base bullion have not
pression, but accumulations of ore have

Lead stocks at end of year at smelters and refineries in the United States, 1929–33[1] *in short tons*

	1929	1930	1931	1932	1933
Refined pig lead	41,726	95,521	117,166	164,722	191,624
Antimonial lead	9,350	7,723	4,187	11,435	11,437
	51,076	103,247	151,653	176,157	203,061
Lead in base bullion:					
At smelters and refineries	8,313	8,171	12,952	13,911	12,786
In transit to refineries	7,116	4,261	2,971	1,302	2,191
In process at refineries	16,089	14,368	10,228	10,720	10,403
	31,518	26,800	26,151	25,933	25,380
Lead in ore and matte and in process at smelters	28,299	28,697[2]	40,185	61,206	67,263
	110,893	158,744	217,989	263,296	295,704

According to trade estimates,[1] stocks outside the United States showed a small decline in 1933, dropping from 380,000 short tons on January 1 to 375,000 tons on December 31. World stocks, therefore, may be estimated to have increased from 556,000 to 578,000 tons during 1933. Normally, world stocks amount to approximately 200,000 tons.

DOMESTIC CONSUMPTION

New supply.—The following table shows the refined primary lead available for consumption from 1929 to 1933. The computation does not take into account changes in producers' stocks, and as these have increased steadily during the past 5 years the quantities shown overstate actual consumption of new lead. Nevertheless, the supply available for consumption in 1933 was equivalent to only 35 percent of that in 1929.

Refined primary pig lead available for consumption in the United States, 1929–33, in short tons

	1929	1930	1931	1932	1933
Supply:					
Stock in bonded warehouse Jan. 1	4,139	1,328	(1)	(1)	(1)
Imports of pigs, bars, and old	1,658	209	10	44	63
Production	774,633	643,033	442,764	288,361	273,579
	780,430	644,570	442,774	288,405	273,642
Withdrawn:					
Exports—					
Pig lead	73,251	48,307	21,665	23,516	22,835
In manufactures, with benefit of drawback	13,086	12,161	10,503	7,220	6,508
Stock in bonded warehouse Dec. 31	1,328	(1 2)	(1)	(1)	(1)
	87,665	61,796	32,168	30,736	29,343
Supply available for consumption	692,765	582,774	410,606	257,669	244,299

[1] Stocks of pigs, bars, etc., in bonded warehouse not separately recorded after April 1930 but included with base bullion. (See table on p. 92.)

[2] For purpose of calculating quantity available for domestic consumption, stocks in warehouse are estimated to have remained unchanged from the beginning of the year.

[1] Metal Bulletin, London, Jan. 30, 1934, p. 12.

Consumption by uses.—Owing to the la
from the lead-consuming industries the t
greatly exceeds the supply of new lead av
gives the American Bureau of Metal Sta
consumption of lead by industries during

Lead consumed in the United States,[1]

Purpose	1929	19
White lead	110,700	8
Red lead and litharge	30,000	3
Storage batteries	210,000	16
Cable covering	220,000	20
Building	90,000	6
Automobiles	18,000	1
Railway equipment	5,700	
Shipbuilding	300	
Ammunition	41,100	3
Terneplate	4,200	
Foil	39,800	2
Bearing metal	33,000	2
Solder	37,000	2
Type metal	18,000	1
Calking	31,500	2
Castings	18,000	1
Other uses	50,000	4
	972,300	76

[1] Source: American Bureau of Metal Statistics. These estir
irrespective of whether its origin be primary or secondary. An

The industrial use of lead in 1933 incr
there was a decrease in the supply of ne
consumption was met by increased us
storage-battery industry ranked first in
margin, showing an increase of 7 percen
was the second largest consumer, using 8
The use of lead for cable covering, wh
and second in 1931–32, declined 44 perc
fourth place. This was the fourth conse
for lead and reflects the low rate of i
Compared with 1929 lead consumption f
was as follows: Storage batteries, 70 per
ammunition, 79 percent; cable covering
27 percent. Lead used in foil increased
equivalent to 57 percent of the 1929 ton

There were few developments in the
new alloy containing less than 0.1 perce
market; it is claimed to have much great
fatigue limit than ordinary lead and eve
sion by sulphuric acid. The architectur
slowly, and some progress has been ma
mental household objects.

PRICES

The two major markets for lead in the
and St. Louis; a large part of the lead p
is sold at prices based on quotations i
York quotations are influenced to som
usually prevailing on the London mar

price seldom exceeds the St. Louis price by as much as the freight differential, 0.37 cent a pound.

The price of lead in 1933 made a substantial recovery from the extremely low level of 1932. The average New York quotation was 3.87 cents per pound, an increase of 22 percent over 1932. However, it was 9 percent below the average of 1931 and 43 percent below that for 1929. At the beginning of the year the quotation was 3 cents, the low for the year (the 1932 low was 2.65 cents). This level held until after March 4, when there was a sharp flurry upward following an increase in demand. This proved to be short-lived, however, and toward the end of March the quotation again settled to 3 cents. About this time one of the large producers announced a sharp reduction in production. This and the revelation of the Government's program for economic recovery stimulated a buying movement in anticipation of higher prices. Further impetus to the price movement was given by abandonment of the gold standard on April 20. On July 10 the high for the year, 4.50 cents, was reached and held until the middle of October. By this time the statistical position had again become unfavorable, and the price settled to 4.15 cents at the close of the year.

The London quotation for 1933 (United States exchange basis) averaged 2.21 cents per pound, 1.66 cents below the New York average. Owing to unsettled exchange conditions the differential between New York and London varied considerably—from 1.41 cents in February to 2.05 cents in August.

The following table shows the average monthly quotations at St. Louis, New York, and London during the past 3 years.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1931–33, in cents per pound [1]

Month	1931			1932			1933		
	St. Louis	New York	London	St. Louis	New York	London	St. Louis	New York	London
January	4.60	4.80	3.01	3.55	3.75	2.31	2.87½	3.00	1.57
February	4.33	4.54	2.92	3.51	3.72	2.25	2.87½	3.00	1.59
March	4.28	4.53	2.85	2.99	3.15	2.01	3.03	3.15	1.63
April	4.17	4.30	2.69	2.90	3.00	1.88	3.13	3.27	1.74
May	3.65	3.82	2.50	2.90	3.00	1.75	3.52	3.65	2.12
June	3.76	3.92	2.52	2.80	2.99	1.66	4.02	4.17	2.45
July	4.22	4.40	2.76	2.50	2.73	1.50	4.30	4.45	2.78
August	4.22	4.40	2.59	3.09	3.24	1.76	4.35	4.50	2.45
September	4.22	4.33	2.41	3.32	3.46	2.03	4.35	4.50	2.49
October	3.78	3.90	2.30	2.94	3.06	1.81	4.18	4.32	2.46
November	3.76	3.94	2.42	2.93	3.05	1.77	4.14	4.29	2.65
December	3.50	3.79	2.29	2.88	3.00	1.63	4.04	4.14	2.61
Average	4.05	4.24	[2] 2.64	3.04	3.18	[2] 1.86	3.74	3.87	[2] 2.21

[1] St. Louis: Metal Statistics, 1934, p. 361. Average daily quotations of soft Missouri lead, f.o.b. St. Louis (open market), as reported daily in the American Metal Market.
New York: American Metal Market, daily issues. Pig lead, New York (outside market), prompt shipment from West.
London: Metal Statistics, 1934, p. 365. Average price of foreign lead. Price per long ton, as published in Metal Statistics, converted to cents per pound at average exchange rate reported by the Federal Reserve Board.

[2] London quotations in pounds sterling per long ton, as follows: 1931, £13.029; 1932, £11.913; 1933, £11.6708.

FOREIGN TR

The foreign trade of the United Sta
imports of ore and base bullion, which
bond, and the export of this lead either
tured products. Since 1927, however, t
In 1933 only 7,608 tons of lead in ore
small amount of refined lead) were imp
tons in 1927; exports of refined lead dec
tons. Lead exported in manufacture
declined from 12,004 to 6,508 tons.

From 1914 to 1918, when foreign pro
World War, exports exceeded imports.
ments the United States ceased to be a
1932 imports exceeded exports. In 19
surplus due to liquidation of stocks of
warehouses.

Imports.—General imports of lead i
percent in 1933. Shipments from Ne
the 1932 total, ceased in 1933, while tho
Chile declined 54, 34, and 71 percent, r
bullion declined 88 percent owing to the
ico. Imports of refined lead were negli
decreased 78 percent compared with 1
with 1929.

Lead imported into the United States, 192

[General Imports

Year	Le or n
1929	
1930	
1931	
1932	
1933	

[1] Reclaimed scrap, etc. No imports of pigs, bars, etc., wer

Lead imported into the United States, in ore, ba sources, in short

[General Imports

Year	Canada	Mexico	S Am
1929	4,512	87,936	
1930	17,268	36,721	
1931	2,618	38,706	
1932	2,459	13,545	
1933	1,629	2,155	

[1] Of this total, 9,708 short tons were from Newfoundland ar
[2] Of this total, 10,598 short tons were from Newfoundland a

Lead imported into the United States, in ore and matte, 1929–33, by countries, in short tons

[General imports]

Country	1929	1930	1931	1932	1933
Canada	3,953	17,257	2,614	2,459	1,629
Chile	2,295	3,313	1,866	2,211	651
Mexico	23,415	16,341	6,495	195	862
Newfoundland and Labrador	(1)		9,708	10,598	
Peru	1,601	831	194	477	522
Sweden				5,024	2,292
Other countries	67	1,635	11	37	2
	31,331	39,377	20,888	21,001	5,958

[1] Less than 1 ton.

Lead imported into the United States, in base bullion, 1929–33, by countries, in short tons

[General imports]

Country	1929	1930	1931	1932	1933
Mexico	63,458	20,350	32,210	13,340	1,281
Peru	19,605	18,280	110	121	306
Other countries	8			1	
	83,071	38,630	32,320	13,462	1,587

Imports for consumption increased in value in 1933 owing to the large increase in receipts of ore and matte as withdrawals from warehouse. Imports of base bullion for consumption decreased 88 percent in 1933.

Lead remaining in warehouses in the United States, December 31, 1929–33, 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	Pigs, bars, sheets, and old	Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old
1929	60,207	75,434	1,328	1932	42,314	3,769	(1)
1930	39,516	[1] 5,642	(1)	1933	21,540	1,058	(1)
1931	52,849	5,343	(1)				

[1] Pigs, bars, and old included with base bullion; not recorded separately for 1930–33.

Lead imported for consumption in the United States, 1929–33, by classes

Year	Lead in ore and matte [1]		Lead in base bullion		Pigs, bars, and old		Sheets, pipe, and shot		Not otherwise specified	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1929	10,823	$1,160,533	6,198	$627,455	10,080	$1,052,087	450	$78,776	$126,966	$3,045,817
1930	15,458	1,461,350	10,423	1,127,920	571	60,493	454	78,737	87,612	2,816,112
1931	10,734	1,194,101	10,430	671,002	[2] 10	[2] 1,763	428	60,536	49,990	1,977,482
1932	9,647	863,135	2,574	131,570	44	2,031	543	53,510	14,848	1,065,103
1933	19,239	1,154,093	306	31,700	45	2,199	518	45,378	13,578	1,246,948

[1] Classification as follows: Jan. 1, 1929, to June 17, 1930, "Lead in ore and matte"; June 18, 1930, through 1933, "Lead in ores, flue dust, and mattes, n.s.p.f."
[2] Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded for 1931.

Miscellaneous products containing lead imported ... States, 1929–33

Year	Babbitt metal, solder, white met... and other combinations conta... ing lead		
	Gross weight (short tons)	Lead content (short tons)	Value
1929	1,505	663	$777,...
1930	1,309	530	593,...
1931	906	310	436,...
1932	498	191	143,...
1933	2	2	1,...

Exports.—Exports of refined lead in 19... tained, having declined only 3 percent; h... only 69 percent of the 1929 total. Japan ... pal buyer, taking 93 percent of the total. ... manufactures with benefit of drawback a... decrease of 10 percent from 1932 and 50 p... half of this was contained in storage batte... exports in 1933 included 174 tons of lead sh... 207 tons of solder, and miscellaneous lea... $234,007.

Refined lead exported from the Unite...

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)	Year
	Short tons	Value		
1929	73,251	$7,178,337	13,086	1932
1930	48,307	3,901,213	12,151	1933
1931	21,665	1,241,881	10,503	

Refined pig lead exported from the United States, ... tons

Destination	
COUNTRY	
Argentina	
Brazil	
Canada	
France	
Germany	
Japan	
Mexico	
Netherlands	
Philippine Islands	
Sweden	
United Kingdom	
Uruguay	
Other	
CONTINENT	
North America	
South America	
Europe	
Asia	
Africa and Oceania	

WORLD ASPECTS OF LEAD INDUSTRY

International Association of Lead Producers.—This organization was formed in September 1928, following a sharp recession in prices during the first part of that year. Membership included the principal producers of the British Empire, Mexico, Germany, Spain, France, Belgium, and Italy. Activities at first were confined to mere exchange of statistical data, but in August 1929 the Mexican and British interests united in a cooperative sales agreement in an endeavor to stabilize the market for lead. During 1930, as stocks mounted rapidly, there was agitation for curtailment of production. Nothing was accomplished until early in 1931 when, according to press reports, an agreement was reached to reduce production on May 1 to 15 percent below the 1930 level. This was increased to 20 percent effective July 1 and again reduced to 15 percent on November 1. It was also reported that agreement had been reached not to sell stocks except at a specified price considerably above the market at that time.

All these measures proved ineffective in reducing the constantly increasing gap between production and consumption. Stocks of lead outside the United States increased from 180,000 long tons at the end of 1929 to 290,000 tons at the close of 1931, and the London price of lead declined from over £22 per long ton in January 1929 to less than £12 in September 1931, when Great Britain abandoned the gold standard. The imposition of the British tariff on lead on March 1, 1932, ended the selling-pool arrangement, and on June 1, 1932, the association technically terminated. Several attempts to renew the agreement during the latter part of 1932 failed, and during 1933 no further effort was made in this direction. However, the statistical service formerly rendered by the association has continued without change from month to month through individual cooperation of the various producers.

World production.—World smelter production of lead in 1933 was maintained at about the same level as in 1932. Production in the United States decreased 4 percent, whereas that of the rest of the world increased 1 percent. The 10 leading producing countries and the percentage of the world total each contributed were as follows: United States, 20.9; Australia, 19.0; Mexico, 10.2; Germany, 10.1; Canada, 10.0; Spain, 7.5; India, 6.3; Belgium, 5.3; Italy, 2.1; and Union of Soviet Socialist Republics (Russia) 1.7. Increases in output were reported as follows: Germany, 23 percent; Australia, 16 percent; Union of Soviet Socialist Republics, 11 percent; Canada, 1 percent; and India, 1 percent. In addition to the United States, Italy showed a decrease of 23 percent; Spain, 18 percent; Mexico, 14 percent; and Belgium, 5 percent. The British Empire has achieved an outstanding position in lead production. From 1925 to 1929 it produced an average of about 370,000 metric tons a year or 22 percent of the total world output. In 1933 Empire production increased to 421,000 tons or 36 percent of the world total. This was an increase of 14 percent over the 5-year average, whereas world production decreased 31 percent.

World production of lead, 1929–33, i

[Compiled by L. M. Jones, of the Bure

Country [1]	1929	1930
Argentina	9,020	8,8
Australia	180,358	171,2
Austria	6,569	6,9
Belgium	82,850	85,3
Canada	138,095	138,1
Chosen	333	1
Czechoslovakia	4,609	4,2
France	20,358	20,1
Germany [1]	97,000	110,8
Great Britain	10,830	10,3
Greece	5,361	7,3
Hungary	100	
India (Burma)	81,621	81,0
Indo-China	17	
Italy	22,650	24,3
Japan	3,374	3,5
Mexico	239,952	242,5
Northern Rhodesia	1,661	
Norway	[3] 300	[3] 3
Peru	19,448	14,9
Poland	35,780	40,9
Portugal	90	
Rumania	505	0
South West Africa [2]	2,802	3,0
Spain	142,753	123,2
Tunisia	18,850	19,4
Turkey	7,324	4,6
Union of Soviet Socialist Republics (Russia)	[4] 6,200	10,7
United States (refined) [5]	636,997	551,6
Yugoslavia	9,471	10,0
	1,786,000	1,696,0

[1] By countries where smelted but not necessarily refined.
[2] In addition to the countries listed China smelts lead, but no r
[3] Approximate production.
[4] Exclusive of secondary material (Metallgesellschaft, Frankfor
[5] Data not available.
[6] Year ended Sept. 30.
[7] Year ended Mar. 31 of year following that stated.
[8] Figures cover domestic refined and lead refined from foreign base bullion not included.

World consumption.—Estimates of wor indicate a total of 1,178,000 metric tons, over 1932. The increase in the United S and antimonial lead) was 14 percent, com where. The leading consumers and the pe each took were: United States, 24.1; Great Germany, 11.7; Japan, 6.3; Russia, 3.1; Be These 8 countries accounted for 86 perc took 65 percent of the total, North and S Asia 8 percent, Australia 1 percent and percent. Besides the United States the suming countries showed increases as follo cent; Japan, 22 percent; France, 15 percent; Belgium, 3 percent. Consumption in Russi 17 percent, respectively.

REVIEW BY COUNTR

Australia.—Production of lead broke al owing to increased production at Mount property reached a peak of 5,215 long to March, but this rate was not maintained

about 113,000 metric tons of ore were imported, of which Germany supplied approximately 70 percent. About 80 percent of the zinc production of Poland is exported; shipments in 1933 amounted to 62,806 tons, of which Germany took 64 percent. As Germany plays such an important part in the Polish zinc industry, the completion of the German Madgeburg zinc plant will require some readjustment of the Polish industry.

Rhodesia, Northern.—The Rhodesia Broken Hill Co. resumed operations at its electrolytic zinc plant in January after having been idle since July 1931. Production for the year was 18,839 metric tons, which exceeded the previous record output of 18,194 tons in 1930. The company reported that its entire output up to the end of 1935 was sold.

Spain.—Preliminary estimates for 1933 indicate a decrease in zinc-mining activity. Production of zinc concentrates is estimated at 59,000 metric tons, compared with 83,000 tons in 1932. A large part of the ore is produced at the Reocin mine in the Province of Santander. This ore is exported mainly to Norway, where it is reduced to metal by the electrolytic process. Exports of ore totaled nearly 75,000 tons in 1933. Some ores, derived as byproducts of lead mining in the southern Provinces, are smelted in the south of Spain. Smelter production declined from 9,505 tons in 1932 to 8,535 tons in 1933.

Yugoslavia.—Trepca Mines, Ltd., treated 542,000 metric tons of ore averaging about 9 percent zinc, 9 percent lead, and 3 ounces of silver per ton. This was an increase of 34 percent over the tonnage treated in 1932. About 84,500 tons of 50-percent zinc concentrates were produced compared with 63,200 tons in 1932. This company is one of the few producers which operated profitably during the depression. Other areas which were worked extensively by the Romans were being actively explored in 1933.

LEAD AND ZINC PIGMENTS AN

By Elmer W. Pehrson and H

SUMMARY OUTLIN

Sales of lead and zinc pigments in 1933 increase of 17 percent over 1932. As per-to ducers were slightly lower, the rise in valu increase in quantity production resulting fr business in the paint, automobile, rubber, t tries, in which lead and zinc pigments are chi of paint sales increased 4 percent, rubber-ti automobile production 43 percent, and au production 12 percent.

Salient statistics of the lead and zinc pigments industr

	1925-29 (Average)	1930
Production (sales) of principal pigments:		
White lead (dry and in oil)..short tons	154,483	102,140
Litharge.....do	84,845	72,578
Red lead.....do	41,302	32,941
Zinc oxide.....do	154,208	119,142
Leaded zinc oxide.....do	26,609	17,270
Lithopone.....do	177,745	104,065
Value of products:		
All lead pigments	$60,092,000	$36,386,000
All zinc pigments	41,314,000	32,867,000
Total	101,406,000	69,253,000
Value per ton received by producers:		
White lead (dry)	178	140
Litharge	176	134
Red lead	193	164
Zinc oxide	133	125
Leaded zinc oxide	124	120
Lithopone	98	97
Foreign trade:		
Lead pigments:		
Value of exports	1,346,000	1,514,000
Value of imports	30,000	17,000
Zinc pigments:		
Value of exports	2,150,000	1,827,000
Value of imports	931,000	785,000
Export balance	2,535,000	2,539,000

[1] Import balance.

The greater part of the 1933 increase was supplied by zinc pigments which advanced 26 percent in quantity and 24 percent in total value; production of lead pigments increased only 9 percent in both quantity and value. All zinc pigments shared in the increase; leaded zinc oxide advanced 60 percent in quantity, zinc oxide 36 percent, and lithopone 16 percent. Unit values of these three pigments decreased 3, 5, and 1 percent, respectively. Of the lead pigments, basic lead sulphate recorded the largest production increase, which amounted to 27 percent. The output of red lead increased 16 percent, orange mineral 9 percent, white lead 9 percent, and litharge 5 percent. Unit values of all lead pigments except white lead were higher in 1933 than in 1932, but the average was half a percent below that in 1932.

Production of zinc sulphate and zinc chloride in 1933 increased 34 and 37 percent, respectively, above 1932.

Foreign trade in lead and zinc pigments was again affected adversely by recessions in exports of white lead to the United Kingdom and zinc pigments to Canada and by increased imports of lithopone. As a result of these changes imports exceeded exports by $8,000, the first import surplus in many years. The extent to which foreign trade has declined is indicated by the fact that in 1933 exports of lead and zinc pigments were valued at only $557,000, compared with an average of $3,496,000 during the 5-year period 1925–29. In the 5 predepression years there was an average export surplus of $2,535,000. This decline was due primarily to the development of domestic production facilities by the principal customers, United Kingdom and Canada, and to the general low level of industrial activity throughout the world. The British preferential tariff also contributed to the decline in United States exports to the British areas in 1933.

The foregoing table contrasts the salient statistics of the lead- and zinc-pigment industry during the past 4 years with the 5-year average 1925–29, and figure 6 shows production and price trends during the past 19 years.

The industry and NRA.— The manufacture of lead and zinc pigments will be governed by the Code of Fair Competition for the Lead Industry and the Code of Fair Competition for the Zinc Industry, respectively, and the manufacture of lead and zinc salts comes under the Code of Fair Competition for the Chemical Manufacturing Industries established on February 10, 1934.

The lead code which became effective on June 4, 1934, provides for administration by the Lead Industries Association and establishes a lead pigments division within the industry. Minimum wages and hours of labor are specified, as well as trade practices for marketing lead pigments. The latter include provisions for free exchange of price data and set up uniform bases for sale of pigments. The code contains no production-control features, but provision is made for action along this line at a later date.

The Zinc Code had not yet been ratified on June 5, 1934. The latest draft available establishes the American Zinc Institute as the administrating agency. Divisions for zinc oxide and lithopone are provided, each of which is governed by a producers' committee. Minimum wages and hours of employment are specified for each division, as well as unfair trade practices and uniform bases of selling. The code contains no provision for control of pigment production, but

free exchange of price lists is mandatory. included in the lithopone division.

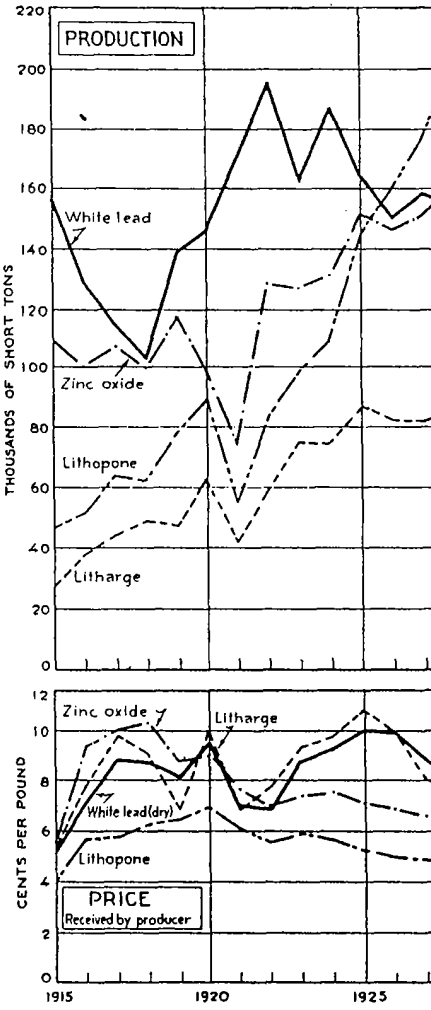

FIGURE 6.—Production and price trends of the principa

PRODUCTION

In this report sales of pigments and salts production, no account being taken of beginning and end of the year. The am their own plants are included under sales.

The total value of lead and zinc pigm ducers was approximately $44,962,000

$38,563,000 in 1932. The total value of all lead pigments sold was $20,819,000 and that of all zinc pigments sold $24,143,000. Sales of lead pigments increased 9 percent in total value and quantity, whereas sales of zinc pigments increased 24 percent in total value and 26 percent in quantity. The average value per ton of lead pigments sold in 1933, as reported by producers, dropped 0.6 percent, whereas the average New York quotation for pig lead increased 22 percent in 1933 compared with 1932. Zinc pigments were 1.3 percent less in value per ton, compared with a 40-percent increase in the St. Louis quotation for slab zinc.

Lead pigments.—All lead pigments shared in the tonnage increase in 1933. Production of white lead was 9 percent above 1932 but 63 percent below the peak of 1922. Production of litharge increased only 5 percent and was 30 percent under the record output of 1929. Basic lead sulphate showed the largest percentage increase (27) in 1933 but was still less than half the 1928 output. Production of red lead and orange mineral increased 16 and 9 percent, respectively. Unit values of all the lead pigments except white lead were higher in 1933 than in 1932 by percentages ranging from 8 for red lead to 13 for litharge. The per-ton value of dry white lead declined 4 percent and that of white lead in oil 9 percent.

Lead pigments sold by domestic manufacturers in the United States, 1932–33

Pigment	1932			1933		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulphate or sublimed lead:						
White	5,708	$534,369	$94	7,320	$736,404	$101
Blue	549	34,125	62	625	65,525	105
Red lead	18,280	2,101,860	111	21,988	2,637,040	120
Orange mineral	212	37,691	178	231	45,928	199
Litharge	58,096	5,155,555	89	61,193	6,197,124	101
White lead:						
Dry	19,946	2,329,876	117	24,028	2,763,630	112
In oil [1]	40,728	8,939,422	191	48,354	8,372,680	173

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

Lead pigments sold by domestic manufacturers in the United States, 1924–33, in short tons

Year	White lead		Basic lead sulphate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1924	42,622	144,872	14,572	1,088	36,813	331	74,724
1925	43,426	120,479	14,906	1,000	41,669	840	86,846
1926	37,908	111,845	12,271	1,236	42,550	913	82,540
1927	38,669	110,026	13,482	1,001	39,073	709	81,055
1928	42,040	111,923	16,002	1,234	40,497	459	85,570
1929	42,159	104,872	15,680	1,234	43,021	678	87,916
1930	32,548	69,502	10,308	1,210	32,941	356	72,578
1931	30,922	66,446	8,706	896	25,853	282	63,890
1932	19,946	46,728	5,708	519	18,880	212	58,096
1933	24,028	48,354	7,320	625	21,988	231	61,193

Zinc pigments and salts.—The following production were recorded in 1933: Zinc ox 60, lithopone 16, zinc chloride 37, and zinc and lithopone production in 1933 were 36 an below the 5-year average for 1925–29. V producers of zinc pigments were lower in 193 of the zinc salts were higher.

Production and value of zinc pigments and salts sol the United States, 1932–

Pigment or salt	1932		
	Short tons	Value (at plant, exclusive of container)	
		Total	Aver
Zinc oxide [1]	72,250	$7,056,697	$
Leaded zinc oxide [1]	14,305	1,296,076	
Lithopone	121,667	10,176,850	
Zinc chloride, 50° B	23,524	1,033,256	
Zinc sulphate	4,252	138,476	

[1] Zinc oxide containing 5 percent or more lead is classed as leade

Zinc pigments and salts sold by domestic manufactu 33, in short tons

Year	Zinc oxide	Leaded zinc oxi
1924	131,470	20,7
1925	151,354	31,7
1926	140,023	23,8
1927	151,246	26,0
1928	160,904	24,2
1929	160,611	27,1
1930	110,142	17,2
1931	95,700	18,6
1932	72,250	14,3
1933	98,542	22,8

CONSUMPTION BY IND

White lead.—By far the principal use of facture of paint, which accounted for 94 pe tion in 1933. The tonnage used in 1933 w 1932 and 50 percent below that in 1929. in the ceramic industry decreased 8 percen

Distribution of white lead (dry and in oil) sa

Industry	1930		1931	
	Short tons	Percent of total	Short tons	Percent of total
Paint	91,563	89.6	91,832	94.3
Ceramics	3,366	3.3	2,848	2.9
Other	7,211	7.1	2,688	2.8
	102,140	100.0	97,368	100.0

Basic lead sulphate.—Consumption of basic lead sulphate in paint manufacture in 1933 was 24 percent above that in 1932 and 47 percent below that in 1929. The use of this pigment in storage batteries has slumped 96 percent since 1929. The white variety is the whitest of the lead pigments, and the blue variety is said to be especially effective in paints used as protective coatings on metallic surfaces.

Distribution of basic lead sulphate sales, 1930–33, by industries

Industry	1930		1931		1932		1933	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Paints	9,573	83.0	8,311	85.8	5,689	90.9	7,072	89.0
Storage batteries	1,104	9.6	697	7.2	195	3.1	99	1.3
Rubber	394	3.4	173	1.8	77	1.2	161	2.0
Other	456	4.0	505	5.2	296	4.8	613	7.7
	11,527	100.0	9,686	100.0	6,257	100.0	7,945	100.0

Litharge.—Notwithstanding a substantial increase in the production of storage batteries in 1933, sales of litharge to this industry decreased 7 percent. A large part of this decrease is believed to be due to increased use of black oxides, although exact information is not available, the development being in the nature of a trade secret. Sales to the insecticide industry also fell off slightly, but large increases were reported in shipments to the oil-refining, ceramic, chrome-pigment, and rubber industries.

Distribution of litharge sales, 1930–33, by industries

Industry	1930		1931		1932		1933	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Storage batteries	33,173	45.7	31,605	49.5	29,365	50.5	27,327	44.6
Insecticides	6,000	8.3	7,508	11.8	11,735	20.2	11,120	18.2
Oil refining	12,028	16.6	7,351	11.5	4,703	8.3	6,070	9.9
Ceramics	4,089	5.6	4,124	6.5	2,903	5.1	5,438	8.9
Chrome pigments	3,286	4.5	3,582	5.6	2,591	4.5	3,973	6.5
Rubber	4,736	6.5	3,032	4.7	1,921	3.3	2,875	4.7
Varnish	698	1.0	641	1.0	1,360	2.3	610	1.0
Linoleum	388	.5	208	.3	169	.3	106	.2
Other	8,180	11.3	5,839	9.1	3,199	5.5	3,698	6.0
	72,578	100.0	63,890	100.0	58,006	100.0	61,193	100.0

Red lead.—The use of red lead in the manufacture of storage batteries in 1933 increased 22 percent but was still 50 percent below that in 1929. The decline compared with 1929 was due partly to the decrease in battery manufacture and partly to the fact that the quantity of red lead used per battery has fallen off considerably. Red lead is used widely as a protective paint for iron and steel; this outlet increased 12 percent in 1933.

Distribution of red lead sales, 193

Industry	1930		1931	
	Short tons	Percent of total	Short tons	Percen of tota
Storage batteries	18,998	57.7	13,700	53.
Paints	10,900	33.1	9,256	35.
Ceramics	835	2.5	811	3.
Other	2,202	6.7	2,086	8.
	32,941	100.0	25,853	100.

Orange mineral.—Sales of orange miner due to increased use in paint manufact "Other" in the following table:

Distribution of orange mineral sales,

Industry	1930		1931	
	Short tons	Percent of total	Short tons	Percer of tot
Ink manufacture	88	24.7	119	42
Color pigments	188	52.8	114	40
Other	80	22.5	49	17
	356	100.0	282	100

Zinc oxide and leaded zinc oxide.—Ow manufacturer to segregate its sales of t Mines is unable to report the consum pigments are used largely in the manu

Total sales of zinc oxide increased 36 zinc oxide 60 percent. Virtually all of in the manufacture of paint. Zinc oxi of rubber, paint, floor coverings, textil ticals. In 1929 it is estimated that ove sold was used in rubber and about 30 p of zinc oxide and leaded zinc oxide in p the role of zinc oxide in rubber manufa

Lithopone.—Sales of lithopone to al in 1933. The paint industry took 14 per textiles 5 percent more, and rubber 28 p popularity of the high-strength lithopon increase in sales compared with a 15 ordinary grades. The use of titanated In 1933 producers reported the use of manufacture of this product compare Lithopone production capacity was rep in 1933 compared with 221,720 tons in

[1] Depew, Harlan A., Zinc Oxide in Rubber: Ind. and Eng

Distribution of lithopone sales, 1929–33, by industries

Industry	1929 (short tons)	1930 (short tons)	1931 (short tons)	1932 (short tons)	1933	
					Short tons	Percent of total
Paints, etc	150,804	126,076	119,446	93,465	106,905	76.0
Floor coverings and textiles	37,506	23,656	20,780	17,601	18,472	13.1
Rubber	7,176	5,997	6,833	3,955	5,078	3.6
Other	10,829	8,336	5,791	6,646	10,286	7.3
	206,315	164,065	151,850	121,667	140,831	100.0

Zinc chloride.—The principal use of zinc chloride is as a wood preservative, and statistics indicate that it is being replaced by creosote in this field. According to the Department of Agriculture the consumption of zinc chloride by wood-treating plants increased from about 8,000 tons in 1909 to a peak of nearly 26,000 tons in 1921. Since then it has dropped to about 12,000 tons in 1928, 3,800 tons in 1932, and about 2,500 tons in 1933. Meanwhile the consumption of creosote increased from 51,000,000 gallons to a peak of 226,000,000 gallons in 1929; it has since declined to 106,000,000 gallons in 1932. Compared with 1928, consumption of zinc chloride in 1932 had declined 67 percent and that of creosote 53 percent. The treatment of railway crossties consumes most of the zinc chloride used in this field, and the low level of consumption in recent years has been due to curtailment of maintenance expenditures by the railroads during the depression. Other important uses for zinc chloride include dry batteries, soldering flux, vulcanized fiber, and oil refining. The latter probably increased considerably in 1933, as trade reports indicate an expansion of refining capacity using the zinc chloride process.

Zinc sulphate.—Sales of zinc sulphate increased 34 percent in 1932. One principal use of zinc sulphate is as a depressant in the flotation of lead-zinc ores. In 1929, 1,425 tons were so used compared with only 509 tons in 1931 and 408 tons in 1932.

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

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and miscellaneous secondary materials, such as scrap and waste from various industrial processes. In 1933 95.4 percent of the lead in lead pigments was derived from pig lead, 4.6 percent from ore, and less than one-tenth percent from secondary material. For zinc pigments and salts the proportions were 56.7 percent from ore, 26.0 percent from slab zinc, and 17.3 percent from secondary materials.

Metal content of lead pigments and zinc pigments manufacturers, 1932–33, by sources,

Source	Lead in pigments
Domestic ore	4,93
Metal	127,31
Secondary material [1]	26
	132,5

[1] Includes also lead recovered in zinc oxide and leaded zinc ox and lead arsenate is not available as no canvass of their production over, these salts are derived from pig lead, and their metal conte account in the figures covering lead production.
[2] Zinc ashes, skimmings, drosses, and old metal.

In the following tables the source of the facture of each pigment and salt is given. either directly or indirectly, in the manufac red lead, and orange mineral and to a large of basic lead sulphate. Zinc oxide is th considerable quantities of slab zinc are use manufacture of zinc oxide, leaded zinc oxid and basic lead sulphate. Some secondary facture of basic lead sulphate, and a substa in lithopone and zinc chloride made in th from secondary material. There was a lar of zinc drosses used in the manufacture of

Lead content of lead and zinc pigments produced b 33, by sources, in short

Pigment	1932			
	Lead in pigments produced from—			Total lead in pigments
	Domestic ore	Pig lead	Secondary material	
White lead		53,784		53,784
Red lead		17,569		17,569
Lithorge		52,877		52,877
Orange mineral		147		147
Basic lead sulphate	1,733	2,941	202	4,936
Leaded zinc oxide	3,199			3,199
Zinc oxide				
	4,932	127,318	262	132,512

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1932–33, by sources, in short tons

Pigment or salt	1932				1933			
	Zinc in pigments and salts produced from—			Total zinc in pigments and salts	Zinc in pigments and salts produced from—			Total zinc in pigments and salts
	Domestic ore	Slab zinc	Secondary material		Domestic ore	Slab zinc	Secondary material	
Zinc oxide	33,295	19,771	325	53,391	42,110	32,784	2,848	77,742
Leaded zinc oxide	7,556	24	.....	7,580	10,913	31	118	11,062
Lithopone	[1] 13,574	.....	11,910	[1] 25,484	[1] 17,749	.....	11,288	[1] 29,037
Zinc chloride	.....	53	5,104	5,157	.....	101	6,680	6,781
Zinc sulphate	507	5	521	1,033	850	.....	864	1,714
	54,932	19,853	17,860	92,645	71,622	32,916	21,798	126,336

[1] Includes zinc content of a small quantity of zinc sulphide produced.

PRODUCERS AND PLANTS

The following companies reported having sold or used lead and zinc pigments and zinc salts of their own production in 1933:

White lead:
- Anaconda Lead Products Co. (electrolytic process) — East Chicago, Ind.
- Carter White Lead Co — West Pullman, Chicago, Ill.
- The Eagle-Picher Lead Co — Cincinnati, Ohio.
- Euston Lead Co — Scranton, Pa.
- W. P. Fuller & Co — South San Francisco, Calif.
- John T. Lewis & Bros. Co — Philadelphia, Pa.
- National Lead Co — Chicago, Ill.
- Do — St. Louis, Mo.
- Do — Perth Amboy, N.J.
- Do — Brooklyn, N.Y.
- Do — Port Richmond, N.Y.
- National Lead Co. of California — Melrose, Calif.
- Sherwin-Williams Co — Chicago, Ill.

Basic lead sulphate, or sublimed lead:
- The Eagle-Picher Lead Co — Joplin, Mo.
- Eagle-Picher Mining & Smelting Co — Galena, Kans.
- St. Louis Smelting & Refining Works of National Lead Co — Collinsville, Ill.

Red lead, orange mineral, and litharge:
- Andrews Lead Co — Long Island City, N.Y.
- The Eagle-Picher Lead Co — East St. Louis, Ill.
- Do — Joplin, Mo.
- Do — Newark, N.J.
- Evans Lead Co — Charleston, W.Va.
- W. P. Fuller & Co — South San Francisco, Calif.

Red lead, orange mineral, and litharge—Continued.
- Grasselli Chemical Co — Ea
- Hammond Lead Products, Inc — Ha
- Morris P. Kirk & Son — Los
- John T. Lewis & Bros. Co — Phi
- Metals Refining Co — Ha
- National Lead Co — Ch
- Do — St.
- Do — Bro
- National Lead Co. of California — Me
- Sherwin-Williams Co — Chi

Zinc oxide and leaded zinc oxide:
- American Zinc Co. of Illinois — Hil
- American Zinc Oxide Co — Col
- The Eagle-Picher Lead Co — Hil
- Empire Zinc Co — Ca
- Grasselli Chemical Co — Ea
- International Lead Refining Co. (French process)
- Do — Ak
- Lowenthal Metals Corporation — Ch
- New Jersey Zinc Co. (of Pennsylvania) — Pal
- Do. (French process) — Fro
- Ozark Smelting & Mining Co — Co
- Röhm & Haas Co., Inc — Bri
- St. Joseph Lead Co — Jos

Lithopone:
- Chemical & Pigment Co., Inc — Oa
- Do — Col
- Do — St.
- The Eagle-Picher Lead Co — Arg
- Krebs Pigment & Color Corporation — Ne
- Do — Ne
- Mineral Point Zinc Co — De
- New Jersey Zinc Co. (of Pennsylvania) — Pal
- Ozark Smelting & Mining Co — Co
- Sherwin-Williams Co — Chi
- United Color & Pigment Co — Ne

Zinc salts:
- American Smelting & Refining Co — Sel
- Do — Du
- Do — Om
- Do — Per
- Charles Cooper & Co — Ne
- General Chemical Co — Chi
- Grasselli Chemical Co — Eas
- Do — Cle
- Do — We
- Great Western Electro-Chemical Co — Pit
- Harshaw Chemical Co — Cle
- Merrimac Chemical Co — Eve
- Ozark Smelting & Mining Co — Co
- Röhm & Haas Co — Phi

PRICES

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

Range of quotations on lead pigments and zinc pigments and salts at New York, 1931–33, in cents per pound

Product	1931	1932 [1]	1933 [1]
Basic lead sulphate, or sublimed lead, dry, casks	6.00– 6.75	5.50– 6.00	5.50– 6.00
White lead, or basic lead carbonate:			
Dry, casks	6.50– 7.25	6.00– 6.50	6.00– 6.50
In oil, carload lots	9.33–10.30	[2]	[2]
Litharge, American, commercial, powdered, casks	5.75– 7.75	[3] 5.25– 6.00	[3] 5.50– 7.00
Red lead, dry, casks	6.75– 8.75	6.25– 7.00	6.50– 8.00
Orange mineral, American, casks	9.50–10.75	8.75–10.75	9.00–11.75
Lead acetate, brown, broken, barrels [1]	10.00–10.50	9.00–10.50	8.50–10.50
Lead arsenate, powdered, drums [1]	10.00–16.00	9.50–14.00	9.00–13.50
Zinc oxide:			
American process, lead-free, bags, car lots	6.50	[4] 5.75– 6.50	[4] 5.75
American process, leaded, barrels, car lots	6.50	[4] 5.75– 6.50	[4] 5.75
French process, red seal, bags, car lots	9.38	[4] 8.63– 9.75	[4] 8.63
French process, green seal, bags, car lots	10.38	[4] 9.63–10.38	[4] 9.63
French process, white seal, barrels, car lots	11.63	[4] 10.88–11.63	[4] 10.88
Lithopone, American, bags, car lots	4.50	[4] 4.50	[4] 4.50
Zinc sulphide, 500-pound barrels	13.00–16.50	13.00–13.50	13.00–13.50
Zinc chloride:			
Solution, [5] tanks	2.25– 3.00	3.00	2.00– 3.00
Fused	5.00– 5.75	5.00– 5.75	4.25– 5.75
Zinc sulphate, crystals, barrels [1]	3.00– 3.50	3.00– 3.50	2.75– 3.75

[1] Compiled from weekly reports.
[2] Figures not available.
[3] Does not specify "American" in 1932 and 1933.
[4] Beginning with June 4, 1932, through December 30, 1933, recorded as 2-ton lots.
[5] At works.

The only changes in the quotations for white lead and basic lead sulphate in 1933 were increases of one-half cent a pound on the 1st of June. At the beginning of 1934 the basis of the quotations was changed to 20-ton lots with a one-fourth cent increase in price for smaller lots. Quotations for the lead oxides fluctuated with the price of lead and were 1¼ cents per pound higher at the close of the year than at the beginning. Prices of red lead were 1 cent higher than litharge throughout the year.

Quotations for American and French process zinc oxides and lithopone were maintained throughout the year. During the last week of the year it was announced that, effective January 1, 1934, the basis of the quotations was changed from 2- to 20-ton carload lots. The new price schedules included an advance of one-tenth cent per pound for American-process, 35-percent leaded zinc oxide, a reduction of one-fourth cent for French-process zinc oxide, and no change for lithopone and other American-process oxides.

FOREIGN TRADE

Imports of lead and zinc pigments and salts increased 8 percent in 1933 and exports declined, so that the substantial export surplus realized in previous years virtually disappeared. The exact status of the export surplus in 1933 is not ascertainable as data on one item are missing. Excluding this item from the totals in 1932 and 1933, an import surplus of $38,000 for 1933 is indicated, compared with an

export surplus of $336,000 in 1932. In 192
in excess of $3,000,000.

The following table shows the value of t
salts imported and exported for 1932–33:

Value of foreign trade of the United States in lead
1932–33

	Import
Lead pigments:	
White lead	$5,0
Red lead	
Litharge	
Orange mineral	
Total	6,3
Zinc pigments:	
Zinc oxide	241,0
Lithopone	271,0
Zinc sulphide	7,
Total	520,8
Lead and zinc salts:	
Lead arsenate	
All lead compounds [1]	46,
Zinc chloride	15,
Zinc sulphate	3,0
All zinc compounds [1]	
Total	65,0
Grand total	592,

[1] Red lead includes orange mineral.
[2] Excluding pigments. Salts not classified separately.
[3] Figures not available.
[4] Exclusive of the value of "all zinc compounds", figures for w

Lead pigments and salts.—Imports of
negligible proportions. The most impor
lead compounds, including lead acetate, le

Lead pigments and salts imported for consumptio
in short tons

Year	Basic carbonate white lead	Red lead
1929	98	5
1930	74	10
1931	68	(1)
1932	29	4
1933	3	1

[1] Less than 1 ton.

The principal exports are white lea
lead arsenate. Exports of white lead, lith
to less than 3 percent of the domestic pro
ments in 1933. Shipments of white lead t
38 percent owing to a 90-percent decline
Kingdom, formerly our principal custome

litharge increased 6 percent; shipments to Canada were 13 percent less in 1933 than in 1932 but still amounted to 52 percent of the total.

Lead pigments and salts exported from the United States, 1929-33, in short tons

Year	White lead	Red lead [1]	Litharge	Lead arsenate	Other lead compounds	Total value
1929	5,908	2,890	(2)	782		$1,616,937
1930	6,546	4,128	(2)	1,135		1,777,169
1931	5,008	3,087	(2)	894		1,123,369
1932	1,681	493	1,493	595		461,694
1933	1,048	570	1,538	209		371,769

[1] Includes litharge from 1929 to 1931 and an unknown quantity of orange mineral, 1929 to 1933.
[2] Included with red lead.

White lead and red lead, orange mineral, and litharge exported from the United States, by destinations, 1930-33, in short tons

Destination	White lead				Red lead, orange mineral, and litharge			
	1930	1931	1932	1933	1930	1931	1932	1933
Countries:								
Argentina	434	67	31	60	96	103	63	109
Canada	66	81	23	75	1,604	1,935	1,268	1,104
Netherlands	257	361	387	377	58	37	4	
Netherland West Indies	3	1	3	2	901	(1)	3	58
Panama	101	1	201	26	79	76	2	68
Philippine Islands	380	112	145	138	144	86	105	104
United Kingdom	4,750	4,235	743	73	442	233	26	17
Others	555	150	148	296	804	617	515	588
Total	6,546	5,008	1,681	1,047	4,128	3,087	1,986	2,108
Continents:								
North America	388	152	326	223	2,814	2,117	1,370	1,404
South America	575	83	75	150	199	223	218	210
Europe	5,075	4,619	1,131	479	701	499	197	213
Asia	484	123	148	141	300	217	170	201
Africa	8	30	(1)	53	7	40	21	80
Oceania	16	1	1	1	107	(1)	1	(1)

[1] Less than 1 ton.

Zinc pigments and salts.—The value of zinc pigments and salts imported again exceeded that exported as a result of increases in receipts of lithopone and zinc chloride and decreases in exports of zinc oxide and lithopone. Lithopone is the most important zinc import of this group; imports increased 8 percent in quantity in 1933; Netherlands supplying 91 percent of the total, Belgium 7 percent, and Germany 2 percent. Imports of zinc oxide decreased 5 percent; the principal sources were United Kingdom 52 percent, Belgium 16 percent, France 16 percent, Canada 9 percent, and Germany 6 percent. Germany supplied 83 percent of the zinc chloride imported.

Zinc pigments and salts imported for consumption in th
short tons

Year	Zinc oxide		Litho-pone	Zi sulp
	Dry	In oil		
1929	1,267	110	8,409	
1930	1,056	79	7,018	
1931	1,352	105	5,674	
1932	2,515	157	4,724	
1933	2,359	182	5,096	

Exports of zinc oxide and lithopone decre
percent, respectively, in 1933, and the total e
commodities declined 51 percent. Almost all
the drop in shipments to Canada, which, h
the principal consumer.

Zinc pigments and salts exported from the United S

Year	Zinc oxide	Litho-pone	Zinc salts	Total value	Year	Z ox
1929	17,638	4,556	1,711	$2,010,140	1932	
1930	10,753	3,665	1,558	1,956,085	1933	
1931	5,131	3,821	1,011	1,146,395		

[1] Zinc salts not separately recorded. [2] Exclus

Zinc oxide and lithopone exported from the United Sta
in short tons

Destination	Zinc oxide			19
	1930	1931	1932	
Countries:				
Argentina	68	171	70	
Canada	4,547	2,818	740	
Cuba	91	58	23	
France	428	1	4	
United Kingdom	4,719	1,523	97	
Others	900	560	318	
Total	10,753	5,131	1,261	
Continents:				
North America	4,812	2,998	904	
South America	105	217	94	
Europe	5,378	1,713	110	
Asia	176	93	61	
Africa	14	8	5	
Oceania	268	102	81	

[1] Less than 1 ton.

drawing and spinning technique leading to production of seamless tubing; notable progress also was reported in control of grain growth through treatment of the tantalum powder, working and annealing schedules that assure fine-grain metal, and rolling and hardening technique. A metallurgical process was developed for sheet which has to be hardened and lapped, whereby a fine mat finish free from pits may be obtained by the removal of only two or three ten-thousandths inch. By a combination of unique methods of resistance and arc welding, it is now possible to fabricate large units and intricate shapes from relatively small sheets. Many of the commercial applications of tantalum are due to its remarkable resistance to chemical corrosion. However, it is one of the most satisfactory metals for thermionic valves and finds extensive use in electrolytic rectifiers. Its use in various kinds of steel has been patented, and certain of its nonferrous alloys are considered worthy of commercial investigation.

Columbium has properties remarkably similar to those of its twin metal tantalum, except for its lower melting point. Generally associated in nature with tantalum and possibly somewhat less scarce, columbium nevertheless has not hitherto found any tangible commercial applications. Mention has been made of its use in sintered carbide tools, and it has also been employed in high-speed steel of European origin but merely as an associate of or partial substitute for tantalum and not for itself. Columbium metal was offered commercially a few years ago by the Fansteel Products Co., Inc. (North Chicago, Ill.), but it has remained more or less of a laboratory curiosity. In 1933, however, Dr. F. M. Becket and associates in the Union Carbide & Carbon Research Laboratories made two important announcements relative to the discovery of remarkable effects of columbium in plain chromium and chromium-nickel steels. Tantalum is not recommended, even as a neutral accompaniment of the columbium, although under certain conditions it may yield similar results. The first paper by Becket and Franks [38] describes the softening effect of columbium in plain high-chromium steels. In amounts up to about 10 times the carbon content, columbium is very efficacious in keeping such steels soft and workable, both hot and cold; the indicated result is a much wider application of these steels, as greater softness and ductility and substantial freedom from air hardening are obtained without loss of resistance to corrosion or high-temperature oxidation.

A second paper by the same authors [39] gives the results of the introduction of columbium to steels of the 18-percent-chromium, 8-percent-nickel type. Such steels previously have been limited in their applications because of intergranular corrosion when exposed concurrently to elevated temperatures and chemical corrosion, and the effectiveness of columbium in inhibiting this defect without the sacrifice of other valuable properties opens up new fields. A number of other addition agents, including titanium which is the one generally employed for this purpose, were tested under similar conditions, but none of them afforded as satisfactory a solution of the problem. Of special interest is the protection obtained from localized failure in welds and adjacent zones. The alloying addition is made in the form

[38] Becket, F. M., and Franks, R., Titanium and Columbium in Plain High-Chromium Steels: Am. Inst. Min. and Met. Eng. Tech. Pub. 506, 1933, 14 pp.
[39] Becket, F. M., and Franks, R., Effects of Columbium in Chromium-Nickel Steels: Am. Inst. Min. and Met. Eng. Tech. Pub. 519, 1934.

of ferrocolumbium containing 50 to 60 pe
low carbon content. For steels of normal
quantity of columbium required generally is
in certain cases less than 0.5 percent is su
alloy through the slag to a thoroughly dec
pouring, recoveries of 80 to 90 percent of the c
in the finished steel. Under these circumst
bium treatment is expected to be no handic
replace titanium wherever extraordinary co

Imports.—Imports of tantalum ores into t
Australia, were 14,257 pounds valued at $2
less than one-half those in 1932, when ship
pounds valued at $51,033, but almost up t
15,250 pounds in 1929. In 1931 only 6,288
8,474 pounds were imported.

World production.—The world supply of
come mostly from the Pilbarra field in W
sional small lots have been shipped from Brit
a Russian expedition to the Kzyl-Kum De
covered tantalite there. Specimens have be
tina and elsewhere in South America. In t
demand for columbite high in columbium
impending new developments in British Af
the supply of byproduct columbium fro
tantalum is deemed inadequate and unduly

TITANIUM

The concentrating plant of the Americ
years the principal producer of titanium min
was not operated in 1933, but shipments w
at a normal rate. The Southern Minera
operations and made shipments of ilmenit
phate, but its pigment production was still
mental basis. Both these enterprises are i
of Mines has no information as to any prod
other States. The deposits in Arkansas co
tion, but no production or shipments were
ore previously produced remained unsold.
production cannot be published without re
tions, but it is common knowledge that the
several hundred tons of rutile and a thousan
annually. A good description of the Virgin
sion of their economic possibilities was publ

The Titanium Pigment Co. (subsidiary o
and the Krebs Pigment & Color Corporat
continued to be the leading makers of titaniu
years the former company has been consid
as its present factory is in St. Louis, Mo.
N.J., was purchased in 1933, but it is repo
not be utilized for this purpose and that th
the eastern seaboard will be built in the nea
Statistics of titanium-pigment production ar
statistics for ilmenite, due partly to the var

[40] Ryan, C. W., The Ilmenite-Apatite Deposits of West-Centra
May 1933, pp. 266–75.