UNITED STATES DEPARTMEN

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BUREAU OF M

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MINERALS YI

1935

Compiled under the su

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UNITED STAT

GOVERNMENT PRINT

WASHINGTON

LEAD

By Elmer W. Pehrson and H. M

SUMMARY OUTLINE

The lead industry of the United States remai
ondition during 1934. Production again ex
hat there was further increase in stocks of
uence, the price trended downward throug
om 4 cents per pound (New York) at the
the close. The average was 3.86 cents
1933. Production of refined primary lead i
933. The output of secondary lead, althoug
933, continued to supply a very large part of
on of primary and secondary lead increase
es associated with automobile manufactur
small increase in the use of lead in cable
decline in this major outlet for lead. Stock
eased 17 percent, but since there was a su
aterials on hand and in process at refiner
creased only 6 percent. Production at the m
1934.

Outside the United States consumption increased 17 percent, pr
duction increased 15 percent, and stocks of refined lead declined
percent, yet in spite of this marked improvement in the statistic
position the London quotation for lead fell from 2.55 cents per pou
(United States exchange basis) in January to 2.28 cents in Decembe
This adverse price trend was attributed to the method of applyi
the British preferential tariff on lead by which small offerings
foreign lead unduly depressed the London Metal Exchange quotation
At the close of the year the situation was being studied by the Briti

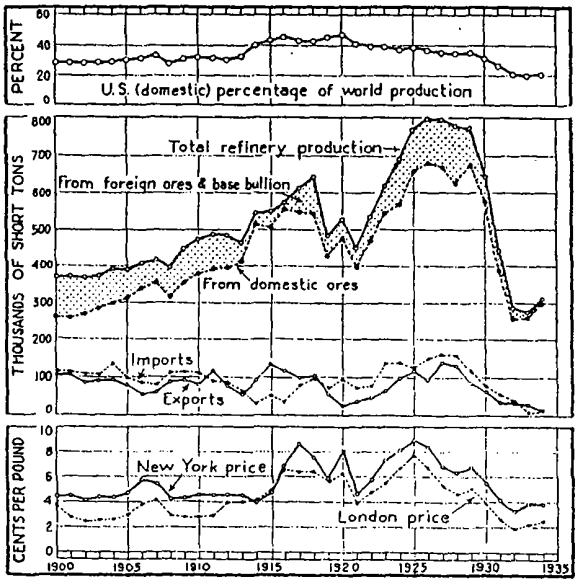


FIGURE 11.—Trends in the lead industry in the United States, 1900-34. Imports include lead in ore, bullion, and refined; exports include refined lead and lead exported in manufactures with benefi drawback. Imports shown for 1934 include lead imported for immediate consumption plus mate entering the country under bond and are closely comparable to "general imports" shown for 1900-33.

Government. No attempt was made to revive the Internation
Association of Lead Producers during the year, and the statistic
service which had been continued after the collapse of the cartel
voluntary cooperation of the more important producers ended
October 1934.

The recovery in the lead industry outside the United States is
striking contrast to the recovery in the domestic industry. In 19
consumption of lead in the United States equaled only 46 percent
the 1929 total, whereas elsewhere it slightly exceeded the 1929 lev
Likewise domestic production was only 44 percent of the 1929 to
while foreign production was over 90 percent.

Salient statistics of the lead industry in the Un

	1925-29 average	1930	193
duction of refined primary lead:			
From domestic ores.....short tons..	660, 525	573, 740	390,
From foreign ores and base bullion short tons..	123, 104	69, 293	52,
	783, 629	643, 033	442,
overy of secondary lead:			
As pig lead.....do....	126, 600	129, 000	128,
In alloys.....do....	153, 400	126, 800	105,
	280, 000	255, 800	234,
tal production of pig lead (primary and econdary).....short tons..	910, 220	772, 033	571,
ports: [1]			
Lead in base bullion.....do....	95, 747	38, 630	32,
Lead in ore.....do....	40, 096	30, 377	20,
ports of refined pig lead.....do....	98, 048	48, 307	21,
fined primary lead available for con- mption.....short tons..	677, 322	582, 774	410,
timated consumption of primary and econdary lead.....short tons..	900, 250	768, 600	567,
ces per pound of refined lead at New ork:			
Highest monthly average.....cents..	10. 33	6. 25	4
Lowest monthly average.....do....	6. 02	5. 10	3
Average for year.....do....	7. 47	5. 52	4
Quotation at end of year.....do....	6. 25	5. 10	3
de production of recoverable lead short tons..	664, 230	558, 313	404,
Southeastern Missouri district percent of total..	30	35	
Utah.....do....	23	21	
Idaho.....do....	21	24	
Joplin (Tri-State) region.....do....	13	7	
All other.....do....	13	13	
rld smelter production of lead metric tons..	1, 678, 000	1, 696, 000	1, 386,
United States.....percent of total..	38	33	
Mexico.....do....	12	12	
Australia.....do....	10	10	
Canada.....do....	7	8	
Spain.....do....	9	7	
All other.....do....	24	30	

Data for 1934 include lead imported for immediate consumption
der bond and are comparable to "general imports" given in the table
Subject to revision.
Approximate production.

Lead industry and N. R. A.—The lead indu
esident's Reemployment Agreement until J
fair competition for the industry became e
de were summarized briefly in last year's ch
et the labor provisions of the code wages w
labor decreased in some sections of the cou
wever, wage scales before the code was adop
specified minimum. Since there has been
tivities of the code authority details of th
not available at this time.

National Resources Board report on the lead
ommittee for Mineral Policy of the National
nded the adoption of some means to preve
tocks and to reduce the present surplus to
concluded that specific plans should origi
immediate consideration, however, it su
better statistics of secondary lead to suppl

mation services already available for this industry; (2) establishmen
of consumption forecasts, to be made by a Government agency, suc
as the Bureau of Mines, in cooperation with producers and organize
consumers; and (3) joint action by the industry under public supe
vision to control the accumulation of excess stocks.

Effects of increased precious metal prices on lead mining.—The larg
increases in the prices of gold and silver in 1934 over 1933 increase

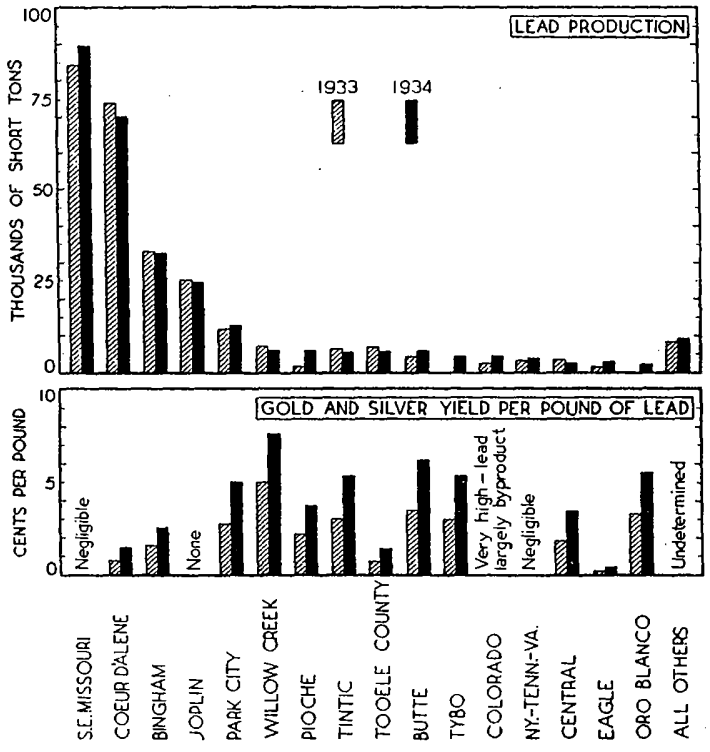


FIGURE 12.—Lead production and approximate gold and silver yield per pound of lead in the princ
lead-producing districts, 1933-34. It is assumed that the gold and silver yield per pound of lead in
was the same in quantity as for the latest previous year in which where was substantial production
most cases 1933. Average prices used in computing yield were as follows: 1933, silver $0.35 and
$25.66 per ounce; 1934, silver $0.6464+ and gold $34.95 per ounce. The average New York price of
was 3.87 cents in 1933 and 3.80 cents in 1934. In Colorado, lead is obtained largely from ores mined
gold and silver, so that the precious metal yield per pound of lead is exceptionally high. The yield f
ores in the miscellaneous districts included in "all others" was not shown, as it would represent m
an average of ores in which the precious-metal revenue per pound of lead varies greatly.

the precious metal revenue of lead producers in the United States
nearly $4,000,000. Since all the auriferous and argentiferous le
and lead-zinc ores are produced in the Western States virtually
of the increase in precious metal revenue was enjoyed by West
producers, thus improving their competitive position with produc
in the Central and Eastern States. But the record for 1934 reve
that the total mine production of lead increased only 5 percent a
that on the average the increase was shared fairly equally by distri
that yield precious metals and those that do not (see fig. 12).

Closer examination of the record, ho
precious metal prices induced considera
otherwise might not have materialized
were resumed at mines, idle in 1933, in
Philipsburg districts. Higher gold and s
the principal factors that contributed to
Park City, Pioche, Butte, and Eagle d
some mines in the Bingham and Tintic dis
Utah, were partly offset by increased proc
possible by the rise in gold and silver reve
tial increase in byproduct lead from gold a
from the following table which gives the
of ores in 1933, with an estimate for 1934:

Lead ore	
Lead-zinc ore	
Gold and silver ore	
Others	

The increase from gold and silver ores v
t precious metal mines in Colorado an
igher gold and silver prices.

In some districts where gold and silve
art of the total revenue lead producti
ccounted for by producers being able
profitably as a result of higher precious m
ome of the smaller mines, by voluntary cu
ccumulation of stocks, by selective mini
old and silver and lower lead values,
igher-zinc ores in lead-zinc mines induc
rice of zinc in 1934. Thus in the Will
precious metal revenue per pound of lea
ead production declined substantially.
utput were recorded in the Coeur d'A
entral districts and in Tooele County.
lver yield in 1934 exceeded 1 cent per p

Enough time probably has not elapse
igher precious metal prices on lead m
ture it seems reasonable to expect th
crease in consumption will be met by
Western States. This region, however
oduction sufficient to meet any large in
nsumption returns to predepression lev
made in the price of lead to permit e
precious-metal-bearing lead mines.
hied that increased gold and silver pri
reasing stocks of lead and have thu
ces. This obviously works to the det
ntain little or no gold and silver.

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 1925 to 1934.

Total pig lead produced in the United States, 1925–34, short tons

Year	From domestic ores and base bullion	From foreign ores and base bullion	From secondary materials	Total
1925	654,021	112,048	112,420	879,3
1926	680,085	118,256	125,000	923,9
1927	668,320	128,210	110,000	915,5
1928	626,202	154,869	138,000	919,0
1929	672,498	102,135	138,500	913,1
1930	573,740	60,293	129,000	772,0
1931	390,260	52,504	128,800	571,5
1932	255,337	33,024	128,000	416,3
1933	260,616	13,963	131,800	406,3
1934	299,841	11,395	124,500	435,7

PRIMARY LEAD

Refinery production.—Production of refined primary lead in 193 increased 14 percent and was equivalent to the normal production a the close of the nineteenth century. Production from foreign ores an base bullion declined 18 percent and was the lowest since 1886, th first year in which lead production from foreign raw materials wa reported. Lead derived from domestic ores increased 15 percent i 1934.

Refined primary lead produced in the United States, 1929–34

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	55,606	235,345	774,633	672,498	29,675	72,460	$0.063	$97,604,0
1930	396,094	45,578	201,361	643,033	573,740	34,348	34,945	.050	64,303,0
1931	203,010	40,456	138,389	442,764	390,260	22,254	30,250	.037	32,765,0
1932	189,707	35,524	63,130	288,361	255,337	21,747	11,277	.030	17,302,0
1933	165,791	22,210	85,578	273,579	259,616	7,677	6,286	.037	20,245,0
1934	186,468	22,744	102,024	311,236	299,841	10,241	1,154	.037	23,031,0

[1] The lead content of antimonial lead is excluded (see p. 82).
[2] Desilverized soft lead is excluded.

Refined primary lead produced in the United States, 192

Source	1929	1930	19
Domestic ore	672,498	573,740	390
Foreign ore:			
Australia	5	3	
Canada	9,490	14,369	3
Europe	28	41	
Mexico	16,807	14,949	6
South America	3,285	3,476	2
Other foreign	61	1,510	9
	29,675	34,348	22
Foreign base bullion:			
Mexico	51,295	18,502	30
South America	21,165	16,353	
	72,460	34,945	30
Total foreign	102,135	69,293	52
Grand total	774,633	643,033	442

Source of primary lead.—Of the total refine 96.3 percent was derived from domestic ores, ores, and 0.4 percent from foreign base bu Foreign ores increased 33 percent in 1934 owi from Newfoundland, Peru, Chile, and Mexic and European (mostly Swedish) ores in 193 ion of refined lead from foreign base bullion 1934, all due to lower production from M over 117,000 tons of Mexican bullion were ref In 1934 less than 1,000 tons were treated. ead derived from domestic ores are given production.

Soft lead.—Nonargentiferous lead ores of soft lead can be produced without elabora known as soft-lead ores. Most of the soft-l United States are smelted into pig lead; bu used each year in the manufacture of le ublimed lead and leaded zinc oxide. Abou roduced from soft-lead ores is desilverized manufacture of white lead where high purit

Soft lead produced in the United States from domesti

Year	Soft pig lead			Soft recovered in m
	Undesilverized	Desilverized	Total	
1929	235,345	55,606	291,011	
1930	201,361	45,578	246,939	
1931	138,389	40,456	178,845	
1932	63,130	35,524	98,654	
1933	85,578	22,210	107,788	
1934	102,024	22,744	124,768	

Includes domestic refined lead, domestic lead in antimonial lead
tic lead in antimonial lead computed on different basis beginn

Antimonial lead.—Antimonial lead or hard lead is an importan byproduct of the refining of base bullion, but the amount derive from this source is only a small part of the country's yearly produc tion. The major part is derived from the smelting of antimonial lea scrap, and some is produced by mixing metallic antimony with refine soft lead.

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

Antimonial lead produced at primary lead refineries, 1929–34

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	Tota
1929	17,062	8,607	17,575	43,244	4,935	11.4	(1)	(1)	(1)	38,2
1930	8,918	4,793	11,086	24,797	2,967	12.0	(1)	(1)	(1)	21,2
1931	(2)	(2)	(2)	21,842	2,438	11.2	3,628	1,603	14,173	19,4
1932	(2)	(2)	(2)	21,024	2,405	11.9	3,677	1,466	13,486	18,2
1933	(2)	(2)	(2)	17,805	1,720	9.7	4,158	791	11,136	16,0
1934	(2)	(2)	(2)	16,607	2,263	13.6	5,901	330	8,113	14,3

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

SECONDARY LEAD

Secondary lead is increasing steadily in importance as a source supply for industry. In 1909, the first year for which adequate da are available, production of secondary lead amounted to less tha 42,000 tons and was equivalent to only 12 percent of the domest primary lead output. During the next two decades production secondary lead increased steadily and more rapidly than that primary lead. By 1929 it had reached a peak of 311,000 tons, equ to 46 percent of the primary output. During the depression t decline in secondary production has been much less pronounced tha in primary production, so that by 1933 the proportion had reach 86 percent. In 1934 a 7-percent decline in secondary output and concomitant increase of 15 percent in primary output brought t proportion down to 70 percent.

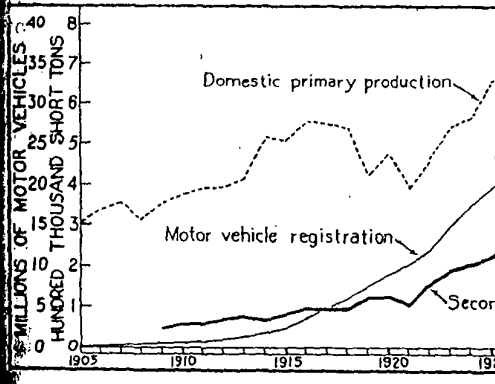
Secondary lead recovered in the United States, 1929–34 [1]

Year	Pig lead (short tons)—			Lead in alloys (short tons)	Total recovered lead		
	At primary plants	At secondary plants	Total		Short tons	Value	Ratio domest refined mary le (perce
1929	65,359	73,141	138,500	172,500	311,000	$39,186,000	
1930	48,135	80,865	129,000	126,800	255,800	25,580,000	
1931	43,774	85,026	128,800	105,900	234,700	17,367,300	
1932	33,611	94,389	128,000	70,300	198,300	11,898,000	
1933	41,632	90,168	131,800	92,700	224,500	10,613,000	
1934	33,657	90,943	124,500	83,900	208,400	15,421,600	

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

The large return of secondary lead is due to
art of the metal consumed each year goes in
ld eventually returns to the smelter for
ypical of such uses are cable coverings, p
aring metal, and most important of all, autom
present, one-half or more of the secondary le
om discarded storage batteries, and the rapid i
ap was the principal factor contributing to th
oduction before the depression. Likewise
pply of battery scrap has aided in maintai
condary lead during the depression.

From 1909 to 1918 the growth of secondar
latively slow. Although the use of storage b
egan before the war it was not until 1921
dopted widely as standard equipment; conse



RE 13.—Trends in production of primary and secondary lead and t
the United States, 1905–34. A large part of the secondary lead is d
ries, and since there has been a relatively small decline in the total nu
ap supply has been maintained relatively well and has been availa
pression. This accounts largely for the small decline in production
mary lead.

ge amounts of battery scrap had not mat
9, however, there was a substantial rise in
bably due to a sharp increase in the sup
llection of which had been induced by the h
d 1918. The new trend was temporarily
ness recession of 1920–21, but from 1921 t
supply of battery scrap resulting from the
mber of automobiles in use is reflected in the
d production.

t present the collection of discarded batt
ng to the universal practice of battery
teries as trade-ins on new ones; thus the s
ly regularly to the smelters and is affecte
es only to a minor extent. Since the num
ation decreased only slightly during the
attery scrap has continued at relatively hig
ted adversely, however, by the tendenc

replacements during hard times, a fact evidenced by the increase i
the average life of a battery from about 2 years in 1928 and 1929 t
2.7 years in 1932. Since then it has declined again to 2.2 years i
1934. Another adverse factor has been the decrease in the quantit
of lead used per battery, which fell from 29 pounds in 1928 to 2
pounds in 1934. Thus, while the total number of motor vehicles i
use only dropped from 26,616,000 in 1929 to 24,933,000 in 193
(6 percent) the supply of lead and antimony in battery scrap fe
27 percent—from 153,000 tons in 1929 to 111,000 tons in 193
according to estimates of the American Bureau of Metal Statistic
Since lead constitutes 96 percent or more of the above tonnages th
lead derived therefrom was equivalent to approximately half of th
total secondary lead production.

LEAD PIGMENTS

Lead pigments manufactured in 1934 contained 165,211 tons
lead from the sources shown in the following table. Of this tot
about 157,294 tons were derived from refined pig lead, of which whi
lead accounted for 41 percent, litharge 42 percent, red lead 16 percen
and sublimed lead and orange mineral 1 percent. Sublimed lead an
leaded zinc oxide are the principal pigments in which the lead conte
is derived from ores.

Lead in pigments,[1] 1929–34, 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	To
1929	9,429	248,657	2,427	260,513	1932	4,932	127,318	262	132,
1930	6,686	190,182	689	197,557	1933	6,875	143,027	56	149,
1931	5,722	166,328	710	172,760	1934	7,538	157,294	379	165,

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

Further details on the production of lead pigments are given in t
chapter on Lead and Zinc Pigments and Zinc Salts.

MINE PRODUCTION

Mine production of recoverable lead in 1934 was nearly 286,7
tons, an increase of 5 percent over 1933; it was 57 percent below t
average for 1925 to 1929. Production in the Western States increas
6 percent, in the Central States 4 percent, and in the Eastern Sta
16 percent.

Compared with the 5-year average for 1925–29 production in 19
was as follows: Western States, 45 percent; Central States, 40 p
cent; and Eastern States, about 89 percent. Missouri continued
rank first in production and increased 6 percent in output. Id
ranked second and Utah third, but decreased 5 and 1 percent, resp
tively, in output. These three States contributed 77 percent of
total output in 1934. Nevada, Montana, Kansas, Colorado,
Arizona produced more lead in 1934 than in 1933, whereas Oklaho
New Mexico, and Alaska produced less. The output of all import
lead-producing States in 1934, except Nevada and New Mexico,
far below the 5-year predepression average.

Mine production of recoverable lead in the United S

State	1925-29 average	1930	1
Western States and Alaska:			
Alaska	982	1,365	
Arizona	9,743	4,246	
California	2,070	1,780	
Colorado	30,112	22,130	
Idaho	141,610	134,068	9
Montana	18,871	10,653	
Nevada	9,807	11,529	
New Mexico	6,730	10,378	1
Oregon	6	5	
South Dakota	21		
Texas	213	198	
Utah	149,509	115,495	7
Washington	1,323	576	
Wyoming			
	370,907	312,413	21
Central States:			
Arkansas	38	53	
Illinois	552	248	
Kansas	26,121	12,910	7
Kentucky	135	101	
Missouri	202,240	199,632	160
Oklahoma	58,306	23,052	13
Wisconsin	1,745	1,537	
	289,137	237,533	181
Eastern States:			
New York			
Tennessee	4,096	8,367	7
Virginia			
	4,096	8,367	7
	664,230	558,313	404

[1] Subject to revision.

Mine production of recoverable lead in the principal l
United States, 1929–34, in shor

District	State	1929	1930	
Southeastern Missouri region.	Missouri	197,435	198,622	
Coeur d'Alene region	Idaho	141,558	129,311	
Bingham	Utah	49,447	42,586	
Joplin region	Kansas, Missouri, Oklahoma.	74,143	36,972	
Park City region	Utah	42,570	30,875	
Willow Creek	New Mexico	5,720	5,431	
Tintic	Utah	44,113	29,474	
Wasatch Valley	do	11,751	10,157	
Butte	Montana	8,239	2,540	
Central	New Mexico	3,766	3,936	
Eagle	Montana		1,287	
Ophir	Utah	25	18	
Shoshone	Colorado	5,172	6,808	
San Juan Mountains	do	17,386	11,722	
Inyo County	California	670	1,711	
Metaline	Washington	328	207	
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	1,536	1,537	
Tanner	Arizona	2,933	929	
Coeur d'Orellie	Idaho	863	956	
Globe (Warren)	Arizona	1,020	151	
Eagle County	Colorado	198	2,821	
Arkansas	Montana	6,137	4,578	
Farm Springs	Idaho	1,507	1,793	
Cedar Plains	Montana	1,177	120	
Grande	Idaho	1,870	529	
Reno	Nevada	1,991	3,622	
San Francisco	Utah	691	1,883	
Talladega	Virginia	(3)	(3)	
Great Rabbit	Nevada	2,430	1,464	
El Blanco	Arizona	(3)	(3)	
Alaska	Nevada	2,986	4,868	
Lawrence County	New York		(4)	

[1] Subject to revision.
[2] Data not available.
[3] Bureau of Mines not at li
[4] Not listed according to ra

STOCKS

Lead stocks, as reported by the American Bureau of Metal Statis-
tics, are shown in the following table. Stocks of refined and anti-
monial lead include metal held by all primary refiners and most of the
refiners of secondary material that produce common lead. Foreign
lead refined in the United States and entered for domestic consump-
tion is included. During the past 6 years stocks of refined pig lead
have increased steadily. At the close of 1934 they were nearly 5.4
times the amount held at the close of 1929. Combined stocks of
refined and antimonial lead on December 31, 1934, exceeded a 7-
month supply at the average rate of consumption in 1934. Stocks of
unrefined lead on hand and in process at smelters declined in 1934.

Lead stocks at end of year at smelters and refineries in the United States, 1929–34
in short tons

	1929	1930	1931	1932	1933	1934
Refined pig lead	41,726	95,524	147,406	164,722	191,624	223,6
Antimonial lead	9,350	7,723	4,187	11,435	11,437	10,4
	51,076	103,247	151,653	176,157	203,061	234,0
Lead in base bullion:						
At smelters and refineries	8,313	8,171	12,952	13,911	12,786	6,0
In transit to refineries	7,116	4,261	2,971	1,302	2,191	1,5
In process at refineries	16,089	14,368	10,228	10,720	10,403	11,5
	31,518	26,800	26,151	25,933	25,380	19,1
Lead in ore and matte and in process at smelters	28,209	28,607	40,185	61,206	67,263	60,6
	110,893	158,744	217,989	263,296	295,704	313,9

According to the annual review of the British Metal Corporatio
stocks of refined lead outside the United States declined in 1934 fro
330,000 short tons on January 1 to 286,000 tons on December 3
The former figure represents a downward revision of 45,000 tons
their estimate given a year ago (375,000 tons). On the basis of th
revised figure world stocks may be estimated to have declined fro
533,000 to 520,000 tons. Normally, world stocks amount to approx
mately 200,000 tons.

DOMESTIC CONSUMPTION

New supply.—The following table shows the refined primary lea
available for consumption from 1929 to 1934. The computation do
not take into account changes in producers' stocks, and as these ha
increased steadily during the past 6 years the quantities shown ov
state actual consumption of new lead. Nevertheless, the supply ava
able for consumption in 1934 was equivalent to only 43 percent of th
in 1929.

ined primary pig lead available for consumption in t
in short tons

	1929	1930	1931
pply:			
Stock in bonded warehouse Jan. 1	4,139	1,328	(1)
Imports of pigs, bars, and old	1,058	209	
Production	774,633	643,033	442,7
	780,430	644,570	442,7
thdrawn:			
Exports:			
Pig lead	73,251	48,307	21,6
In manufactures, with benefit of drawback	13,086	12,161	10,5
Stock in bonded warehouse Dec. 31	1,328	(1)	(1)
	87,665	61,796	32,1
pply available for consumption	692,765	582,774	410,6

Stocks of pigs, bars, etc., in bonded warehouse not separately reco
h base bullion. (See table on p. 91.)
For purpose of calculating quantity available for domestic consump
ed to have remained unchanged from the beginning of the year.

Consumption by uses.—Owing to the large re
m the lead-consuming industries the total c
eatly exceeds the supply of new lead ava
ble gives the American Bureau of Metal Sta
al consumption of lead by industries during

Lead consumed in the United States,[1] in 1929–

Purpose	1929	1930	1931
lite lead	119,700	83,900	77,5
d lead and litharge	30,000	32,000	18,0
rage batteries	210,000	163,000	157,0
ble covering	220,000	208,000	117,0
ilding	96,000	67,000	40,0
tomobiles	18,000	11,000	6,0
lway equipment	5,700	5,200	1,0
pbuilding	300	500	4
munition	41,100	83,300	29,7
eplate	4,200	2,700	2,2
	39,800	26,000	20,0
ring metal	33,000	20,000	12,0
ier	37,000	27,000	20,5
e metal	18,000	16,000	14,4
ring	31,500	21,000	15,0
tings	18,000	12,000	7,0
er uses	50,000	40,000	30,0
	972,300	768,600	567,7

Source: American Bureau of Metal Statistics. These estimates are
pective of whether its origin be primary or secondary. Antimonial

The industrial use of lead increased 10 percen
percent below the 1929 record. Factors
rease in 1934 included the 43-percent rise in
e and the 23-percent increase in building
teries continued to be the largest consumer
cent in 1934. Although this outlet for lea
mber of new automobiles produced the majo
nts in old cars. Out of a total of 12,900,00
nufactured in 1934, 10,121,000 went into rep
mber of automobiles registered in 1934 was

of 5 percent over 1933. To the increase in new automobile production, however, may be attributed the increase in the direct use of lead in automobiles and a portion of the increase assigned to bearing metals.

Consumption of lead in cable covering, normally the largest use of lead, increased slightly in 1934 but was still at very low levels. This was due largely to the sharp decline in the manufacture of telephone cable during the depression.

The revival in construction activity is reflected in the increased use of lead directly in building and in the manufacture of white lead and red lead, which are used largely in paint manufacture. White lead formerly was the principal use of lead and over a decade ago accounted for approximately 25 percent of the lead used in this country. Owing to competition from zinc and titanium pigments, however, its relative importance has decreased to only 14 percent in 1934. The use of lead in ammunition increased again in 1934, whereas lead foil and calking declined substantially. Under "other uses" the largest item in recent years has been the manufacture of tetraethyl lead, which has been increasing rapidly. Compared with 1929 the quantity of lead used in the six principal consuming industries in 1934 was as follows: Storage batteries, 78 percent; white lead, 54 percent; ammunition, 85 percent; cable covering, 16 percent; building, 31 percent; and red lead and litharge, 93 percent.

PRICES

The two major markets for lead in the United States are New York and St. Louis; a large part 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, normally 0.35 cent a pound.

The price of lead in 1934 was slightly lower than in 1933. The average New York quotation was 3.86 cents per pound compared with 3.87 cents in 1933; it was 43 percent below that of 1929. At the beginning of 1934 the price was 4 cents. This quotation was maintained until early in April, when anticipation of higher prices expected as a result of pending approval of the Lead Code and the general improvement in business stimulated a buying wave which brought the quotation up to 4.25 cents. During the latter part of May, however, the downward trend, which began in October 1933 after the inflationary rise in the summer of that year, was resumed and maintained until a low for the year of 3.5 cents was reached during the latter part of November and the first half of December. The quotation at the close of the year was 3.7 cents. The large increase in lead stocks in 1934 and the weakness of the London market affected the domestic price unfavorably in 1934.

The London quotation for 1934 (United States exchange basis) averaged 2.46 cents per pound—1.4 cents below the New York average. Owing to more settled exchange conditions the differential between New York and London was maintained within relatively narrow limits. The London quotations, which declined from £11.30 in January to £10.317 in December, did not reflect a substantial

improvement in the statistical position. The method of applying the 10-percent lead made it possible for small offerings unduly the London market.

Average monthly and yearly quoted prices of lead, 1932–34, in cents per

Month	1932			
	St. Louis	New York	London	St. Lou
January	3.55	3.75	2.31	2.8
February	3.51	3.72	2.25	2.8
March	2.99	3.15	2.01	3.0
April	2.90	3.00	1.88	3.1
May	2.90	3.00	1.75	3.5
June	2.89	2.99	1.56	4.0
July	2.59	2.73	1.56	4.3
August	3.09	3.24	1.76	4.3
September	3.32	3.40	2.03	4.3
October	2.94	3.06	1.81	4.1
November	2.93	3.05	1.77	4.1
December	2.88	3.00	1.63	4.0
Average	3.04	3.18	[3] 1.86	3.7

[1] St. Louis: Metal Statistics, 1935, p. 373. Average daily St. Louis (open market), as reported daily in the American Metal

[2] New York: American Metal Market, daily issues. Pig lead from West.

[3] London: Metal Statistics, 1935, p. 377. Average price of Metal Statistics, converted to cents per pound at average Board.

[4] London quotations in pounds sterling per long ton, at £10.9333.

FOREIGN TRA

The foreign trade of the United States imports of ore and base bullion, which bond, and the export of this lead either factured products. Since 1927, however 1934 only 13,344 tons of lead in ore and amount of refined and scrap lead) was 61,389 tons in 1927; exports of refined to 5,906 tons. During the same period with benefit of drawback declined from

Imports.—Total imports of lead in ore for immediate consumption and entries percent in 1934 due to increased shipments hile, and Mexico. Receipts from Ca and there was no intake of Swedish or illion increased 54 percent, most of ments from Mexico. Imports of refined mports of lead increased 74 percent but 2 percent of the 1929 total.

[5] Figures on imports and exports compiled by Claude Ga the Bureau of Foreign and Domestic Commerce.

Total lead imported into the United States, 1929–34, by classes, in short tons [1]

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1929	31,331	83,071	1,657	116,0
1930	39,377	38,630	209	78,2
1931	20,888	32,320	[2] 10	53,2
1932	21,001	13,462	44	34,5
1933	5,958	1,587	109	7,6
1934	10,611	2,450	283	13,3

[1] Data for 1934 include lead imported for immediate consumption plus material entering the count under bond and are comparable to "general imports" given in the table for 1929–33.
[2] Reclaimed scrap, etc. No imports of pigs, bars, etc., were recorded for 1931.

Total lead imported into the United States, in ore, base bullion, and refined, 1929–3 by sources, in short tons [1]

Year	Canada	Mexico	Newfoundland	South America	Europe	Other countries	Total
1929	4,512	87,936	----------	23,526	14	71	116,0
1930	17,208	36,721	----------	22,472	113	1,642	78,2
1931	2,618	38,706	9,708	2,171	----------	15	53,2
1932	2,459	13,545	10,598	2,811	5,053	41	34,5
1933	1,620	2,154	----------	1,486	2,368	18	7,6
1934	1,160	3,270	3,357	5,455	67	35	13,3

[1] Data for 1934 include lead imported for immediate consumption plus material entering the count under bond and are comparable to "general imports" given in the table for 1929–33.

Total lead imported into the United States, in ore and matte, 1929–34, by countr in short tons [1]

Country	1929	1930	1931	1932	1933	1934
Canada	3,953	17,257	2,614	2,459	1,629	
Chile	2,295	3,313	1,866	2,211	651	1,1
Mexico	23,415	16,341	6,495	195	802	1,2
Newfoundland and Labrador	[2]	----------	9,708	10,598	----------	3,3
Peru	1,601	831	104	477	522	3,6
Sweden	----------	----------	----------	5,024	2,292	----------
Other countries	67	1,635	11	37	2	----------
	31,331	30,377	20,888	21,001	5,958	10,0

[1] Data for 1934 include lead in ore and matte imported for immediate consumption plus material enteri the country under bond and are comparable to "general imports" given in the table for 1929–33.
[2] Less than 1 ton.

Total lead imported into the United States, in base bullion, 1929–34, by countri in short tons [1]

Country	1929	1930	1931	1932	1933	1934
Mexico	63,458	20,350	32,210	13,340	1,281	1,9
Peru	19,605	18,280	110	121	306	----------
Other countries	8	----------	----------	1	----------	----------
	83,071	38,630	32,320	13,462	1,587	2,4

[1] Data for 1934 include lead in base bullion imported for immediate consumption plus material entet the country under bond and are comparable to "general imports" given in the table for 1929–33.

d remaining in warehouses in the United States, De tons

[Stated in the form in which the material was enter

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old	Year
29	60,207	75,434	1,328	1932
30	39,516	[1] 5,642	(2)	1933
31	52,849	[1] 5,343	(2)	1934

Pigs, bars, and old included with base bullion; not recorded sepa

Imports of consumption decreased in valu rge decline in withdrawals of lead in the mports of base bullion for consumption incr

Lead imported for consumption in the United Sta

Year	Lead in ore and matte [1]		Lead in base bullion		Pigs, bars, and old	
	Short tons	Value	Short tons	Value	Short tons	Value
29	10,823	$1,160,533	6,198	$627,455	10,089	$1,052,087
30	15,458	1,461,350	10,423	1,127,920	571	60,493
31	10,734	1,194,191	10,430	671,002	[2] 10	[2] 1,763
32	9,647	863,135	2,574	131,579	44	2,031
33	19,239	1,154,093	300	31,700	45	2,199
34	10,760	558,558	2,220	117,729	285	10,678

Classification as follows: Jan. 1, 1929, to June 17, 1930, "Lead in ore 4, "Lead in ores, flue dust, and mattes, n. s. p. f."
Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded for

iscellaneous products containing lead imported for States, 1929–34

Year	Babbitt metal, solder, white metal, and other combinations containing lead			
	Gross weight (short tons)	Lead content (short tons)	Value	
29	1,505	663	$777,354	
30	1,399	530	593,103	
31	906	310	436,574	
32	498	191	143,662	
33	349	51	30,623	
34	709	102	71,505	

Imports of antimonial pig containing about 14 percent lead formerly imonial lead." In 1934 the Bureau of Foreign and Domestic Co al, solder, white metal, etc."; the 1933 figures are revised to compa

Exports.—Exports of refined lead declined ere equivalent to only 6 percent of the aver he decline in 1934 was due largely to the lo hich increased its purchases from Mexic ustralia.

Foreign lead exported in manufactures with benefit of drawba amounted to 7,472 tons, an increase of 15 percent over 1933. Abo 35 percent of the 1934 total was contained in storage batteries e ported. Other lead exports included: Litharge and red lead, 16 pe cent; sheets, pipes, solder, etc., 15 percent; white lead, 12 percen and electrical apparatus, 11 percent.

Refined lead exported from the United States, 1929–34

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)	Year	Pigs, bars, and old		Foreign le exported manufactu with bene of drawba (short to
	Short tons	Value			Short tons	Value	
1929	73,251	$7,178,337	13,086	1932	23,516	$1,069,697	7,
1930	48,307	3,904,213	12,161	1933	22,831	832,984	6,
1931	21,665	1,241,881	10,603	1934	5,906	304,581	7,

Refined pig lead exported from the United States, 1929–34, by destinations, in short tons

Destination	1929	1930	1931	1932	1933	19
COUNTRY						
Argentina	599	934	226		113	
Brazil	1,538	874	1,382	759	329	
Canada	141	9	58	133	6	
France	2,202	3,001	318	224		
Germany	9,745	823	52	1,344	5	
Japan	16,416	15,653	17,301	20,219	21,236	
Mexico	83	40	171	13	5	
Netherlands	1,522	22	13	112		
Philippine Islands	111	543	400	476	360	
Sweden	7,255	7,657	392			
United Kingdom	23,732	9,157	3			
Uruguay	448	364	145	84	140	
Other	9,459	9,330	1,204	153	637	
	73,251	48,307	21,665	23,516	22,831	
CONTINENT						
North America	693	315	435	160	41	
South America	3,852	2,442	1,903	863	732	
Europe	50,649	27,599	795	1,793	5	
Asia	18,055	17,289	18,524	20,700	21,693	
Africa and Oceania	2	350	8		360	
	73,251	48,307	21,665	23,516	22,831	

[1] Less than 1 ton.

WORLD ASPECTS OF LEAD INDUSTRY

International cooperation.—No attempt was made during 193 revive the Lead Cartel, which went out of existence with the im sition of the British tariff on lead in 1932. The cooperative arra ment between the more important foreign producers, by which reg compilation of statistics had been continued after the collapse o cartel, ended in October 1934 because one of the larger producers unwilling to continue giving its figures.

World production.—World smelter production of lead increase percent in 1934 but was equivalent to only 74 percent of the re output of 1929. Production increased 16 percent in the U States and 15 percent in the rest of the world. The United S was the leading producer and contributed 21.3 percent of the

otal, approximately the same as in 1933. ducing countries and the percentage of th ited in 1934 were as follows: Australia, 1 10.8; Germany, 9.1; Belgium, 5.7; Spain, Tunisia, 2.1; and U. S. S. R. (Russia), 2.0. States other important producers showed t creases: Mexico, 40; Canada, 24; Germany Tunisia, 84; and U. S. S. R. (Russia), 97. irtually unchanged, while that in Austra nd 16 percent, respectively. Productio mounted to about 434,000 metric tons in ent over 1933 and 17 percent over the 5-y Empire's share of world output was 33 perc 2 percent from 1925 to 1929.

World production of lead, 1929–34,

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

Country [1]	1929	1930	
Argentina	9,020	8,882	
Australia	180,358	171,248	
Austria	6,509	6,935	
Belgium	82,850	85,370	
Canada	138,095	138,105	
Chosen	333	130	
Czechoslovakia	4,609	4,225	
France	20,358	20,170	
Germany [2]	97,900	110,800	
Great Britain	10,839	10,383	
Greece	5,361	7,329	
Hungary	109	70	
India (Burma)	81,521	81,010	
Indo-China	17	11	
Italy	22,650	24,340	
Japan	3,374	3,581	
Mexico	239,952	242,537	
Northern Rhodesia	1,661		
Norway	[3] 300	[3] 300	
Peru	19,448	14,979	
Poland	35,789	40,900	
Portugal	96	89	
Rumania	565	984	
South-West Africa [4]	2,802	3,661	
Spain	142,753	123,263	
Tunisia	18,850	19,400	
Turkey	7,324	4,664	
United States (refined) [5]	636,907	551,645	
U. S. S. R. (Russia)	[6] 6,200	10,750	
Yugoslavia	9,471	10,049	
	1,786,000	1,696,000	1,

[1] By countries where smelted but not necessarily refined.
[2] In addition to the countries listed China smelts lead, but no re
[3] Data not available.
[4] Exclusive of secondary material (Metallgesellschaft, Frankfurt)
[5] Approximate production.
[6] Year ended Mar. 31 of year following that stated.
Figures cover domestic refined and lead refined from foreign o bullion not included.
Year ended Sept. 30.
Approximate production based on output of countries shown ent of the total world output.

World consumption.—World consumptio ted at 1,338,000 metric tons, an increase increase in the United States, after oks and including secondary and anti mary refineries, was only 6 percent comp ere. For the first time in many years

Magdeburg plant in Germany during the latter part of 1934 deprived Poland of a large supply of ore from German Upper Silesia and a market for metallic zinc in Germany. This situation is reflected to some extent in the trade statistics for 1933 and 1934, which show a decrease in German exports of ore to Poland from 79,000 metric tons to 63,000 tons. The magnitude of the change, however, is shown more accurately by a comparison of December 1934 with December 1933. In these two periods German exports of ore to Poland declined from 5,600 to 1,100 tons, and imports of Polish zinc fell from 4,100 to 1,800 tons. This situation led to the closing down of one Polish smelter early in 1935. At the close of the year it was reported that an agreement had been made with Japan whereby Japan was to take Polish zinc in exchange for silk and other manufactured products. Giesche Spolka Akcyjna, Polish subsidiary of the Anaconda Copper Mining Co., produced about 41,000 tons of zinc in 1934, compared with 36,000 tons in 1933.

Spain.—Further decline in zinc mining is indicated by the decrease in exports of zinc ore from 75,000 metric tons in 1933 to 56,000 tons in 1934. 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. Some ores derived as byproducts of lead mining in the southern provinces, are smelted in the south of Spain. Smelter production amounted to about 8,000 tons in 1934.

U. S. S. R. (Russia).—Production of zinc in 1934 was about 26,000 metric tons, including about 5,000 tons of eletrolytic zinc. Under the second 5-year plan production was to have been 97,000 tons in 1934. More than 4,000 tons of zinc were imported in 1934, indicating a consumption exceeding 30,000 tons. Zinc smelters are located at Constantinovo and Byelovo, each with an annual capacity of 12,000 tons. Another at Ordjonikidze has a capacity of 6,000 tons. In addition to the smelter there is an electrolytic-zinc plant at Ordjonikidze whose capacity was being doubled in 1934. The electrolytic plant at Cheliabinsk is expected to be put into operation during 1935. Inability of the reduction plants to attain capacity production was attributed to unsatisfactory exploitation of the zinc mines. At the close of 1934 zinc reserves were estimated at 7,400,000 tons.

Yugoslavia.—Trepca Mines, Ltd., treated 599,000 metric tons of ore from which were obtained 93,000 tons of 50-percent zinc concentrates and 64,000 tons of 79-percent lead concentrates. This was an increase of 10 percent in production of zinc concentrates. Costs were higher owing to the depreciation of the British pound. Only a small part of the ore is treated in Yugoslavia, the major part being shipped to Belgium for smelting. Smelter production was only 3,500 tons.

LEAD AND ZINC PIGMENTS AND Z

By ELMER W. PEHRSON AND H. M.

SUMMARY OUTLINE

Sales of lead and zinc pigments in 1934 to
increase of 7 percent over 1933, but most of th
improved prices, as the combined tonnage of le
increased less than 2 percent. In view of the
dollar volume of paint sales, the 30-percent i
manufacture, the 43-percent rise in automobil
17-percent rise in storage-battery output—al
suming industries—it is apparent that lead and
facturers did not receive a proportionate sha
business.

Lead pigments fared better than zinc pigmen
Sales of all lead pigments increased 15 percent
cent in quantity, whereas sales of zinc pigment
in value and decreased 3 percent in quantity.
ments except sublimed lead increased in 1934
the principal zinc pigment, also increased, but
leaded zinc oxide were substantially lower. U
pigments and all lead pigments except blue subl
1934.

Increased competition was felt in 1934 fro
production of which has risen steadily during
estimated [1] that 32,000 tons of titanium diox
1934. Since a large part of the dioxide is mixe
total tonnage of titanium pigments marketed p
ably higher. These pigments are finding exten
placing the white lead and zinc pigments, altho
have been affected most seriously in 1934. T
substituted for zinc oxide and lithopone in the
rubber goods, paper, and other commodities wh
and opacity are desired. Additional productio

[1] Chemical and Metallurgical Engineering, Progress in Pigment Ind
January 1935, p. 49.

construction indicates that titanium is destined to supply even more of the pigment demand.

Other factors have curtailed consumption of zinc oxide in the rubber industry and the use of litharge in storage batteries. In the compounding of rubber the recent introduction of new accelerators has reduced the quantity of zinc oxide used per ton of rubber products. Battery manufacturers now are manufacturing in increasing quantities a black or suboxide of lead which they use in place of litharge in battery plates. For this reason sales of litharge in recent years have not kept up with the increased production of storage batteries.

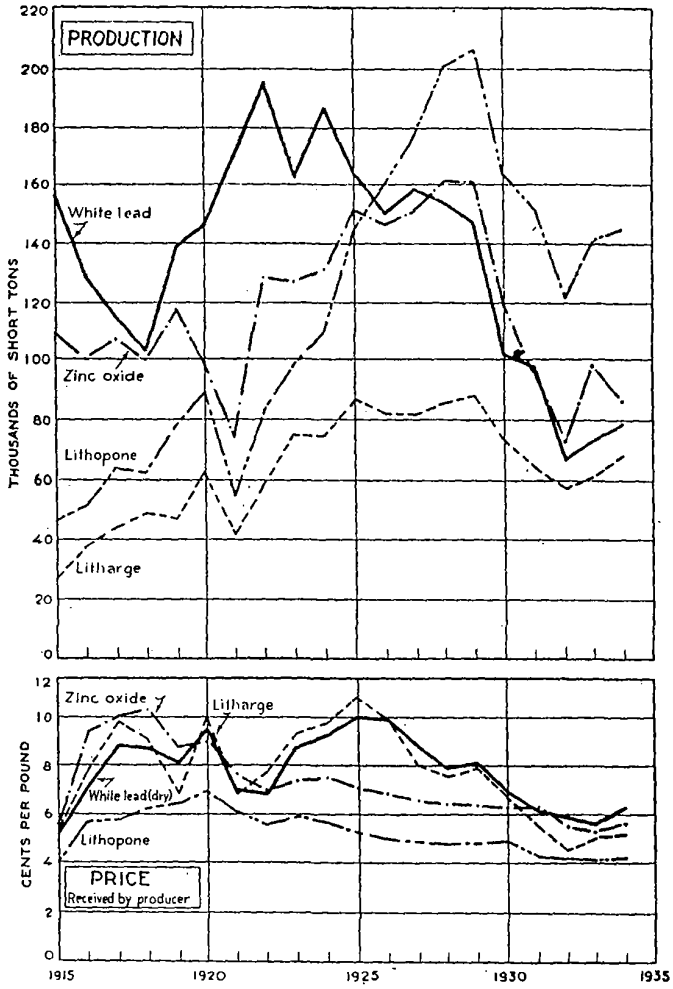


FIGURE 15.—Production and price trends of the principal lead and zinc pigments, 1915-34.

Salient statistics of the lead and zinc pigments in

	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	26,600	17,279
Lithopone do	177,745	164,065
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	154
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 industry and N. R. A.—The m
1934 was governed by the Code of F
Industry which went into effect on J
features of the code were not put int
provided for in the zinc oxide and li
established for the zinc industry on Aj

PRODUCTI

In this report sales of pigments and s
production, no account being taken of
ginning and end of the year. The q
their own plants are included under sa

The total value of lead and zinc p
ducers was approximately $48,108,0
$44,962,000 in 1933. The total value
$24,002,000 and that of all zinc pigme
lead pigments increased 15 percent in
quantity, whereas sales of zinc pigmen
value and decreased 3 percent in qua
ton of lead pigments sold in 1934, as re
4.4 percent, whereas the average Ne
declined 0.3 percent. Zinc pigments
per ton, compared with a 3.2-percent i
tion for slab zinc.

Lead pigments.—Production of whi
orange mineral increased in 1934, wh
creased. Production of white lead in

percent below the peak of 1922. Likewise production of litharge was 12 percent higher in 1934 but was still 22 percent under the record output of 1929, and output of red lead, which increased 22 percent in 1934, was 38 percent below 1929. Production of sublimed lead was 11 percent less than in 1933. Unit values of all lead pigments except blue sublimed lead increased in 1934.

Lead pigments sold by domestic manufacturers in the United States, 1933–34

Pigment	1933			1934		
	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	7,320	$736,404	$101	6,309	$677,897	$106
Blue	625	65,525	105	668	69,043	103
Red lead	21,088	2,637,640	120	20,743	3,279,013	123
Orange mineral	231	45,928	199	234	50,778	217
Litharge	61,193	6,197,124	101	68,733	7,083,509	103
White lead:						
Dry	24,628	2,763,630	112	22,509	2,838,709	126
In oil [1]	48,364	8,372,689	173	56,165	10,002,820	178

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

Lead pigments sold by domestic manufacturers in the United States, 1925–34, in short tons

Year	White lead		Basic lead sulphate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1925	43,426	120,479	14,996	1,090	41,669	840	86,646
1926	37,068	111,845	12,271	1,236	42,550	813	82,540
1927	38,669	119,026	13,482	1,061	39,073	709	81,655
1928	42,049	111,923	16,002	1,234	40,497	459	85,570
1929	42,159	104,872	15,580	1,234	43,021	678	87,916
1930	32,548	69,592	10,308	1,219	32,941	356	72,678
1931	30,922	66,440	8,790	890	25,853	282	63,890
1932	19,946	46,728	5,708	549	18,880	212	58,096
1933	24,628	48,354	7,320	625	21,988	231	61,193
1934	22,509	56,165	6,399	668	26,743	234	68,733

Zinc pigments and salts.—Production of zinc oxide and leaded zinc oxide declined 12 and 10 percent, respectively, in 1934, whereas that of lithopone increased 3 percent. The 1934 tonnages were equivalent to the following percentages of the 1929 outputs: Zinc oxide 54, leaded zinc oxide 76, and lithopone 71. Unit values of all three pigments increased in 1934.

Zinc pigments and salts sold by domestic manufact

Pigment or salt	1933	
	Short tons	Value (exclusiv tainer)
		Total
Zinc oxide [1]	98,542	$10,379,937
Leaded zinc oxide [1]	22,868	2,011,761
Lithopone	140,831	11,751,500
Zinc chloride, 50° B	32,187	1,459,745
Zinc sulphate	5,698	221,780

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

Zinc pigments and salts sold by domestic ma 1925–34, in short

Year	Zinc oxide	Leade oxi
1925	151,354	3
1926	146,923	2
1927	151,246	2
1928	160,904	2
1929	160,611	2
1930	119,142	1
1931	95,700	1
1932	72,250	1
1933	98,542	2
1934	87,088	2

CONSUMPTION BY IN

White lead.—Over 95 percent of the w the manufacture of paint. The tonnage above that in 1933 and 45 percent below of white lead in the ceramic industry d

Distribution of white lead (dry and in oil)

Industry	1931		1932	
	Short tons	Percent of total	Short tons	Percen of tota
Paint	91,832	94.3	63,399	95.
Ceramics	2,848	2.9	1,761	2.
Other	2,688	2.8	1,514	2.
	97,368	100.0	66,674	100.

Basic lead sulphate.—This pigment is u quantity so used in 1934 was 7 percent percent below that in 1929. In 1929 o sulphate were used in storage batteries, small tonnages during the depression.

Distribution of basic lead sulphate sales, 1931–34, by industries

Industry	1931		1932		1933		1934	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Paints	8,311	85.8	5,689	90.9	7,072	89.0	6,611	93.[illegible]
Storage batteries	697	7.2	195	3.1	99	1.3	139	2.0
Rubber	173	1.8	77	1.2	161	2.0	93	1.[illegible]
Other	505	5.2	306	4.8	613	7.7	224	3.[illegible]
	9,686	100.0	6,267	100.0	7,945	100.0	7,067	100.[illegible]

Litharge.—The principal use of litharge is in the manufacture of storage batteries, but this outlet has been affected adversely by the growing tendency of battery makers to substitute a black oxide, or suboxide, of lead, which they manufacture themselves. This practice began in 1923, and by 1929 a total of 33,000 tons of the black oxide was being made. In 1931 the tonnage declined to about 23,000, but since then has increased again to nearly 33,000 in 1934, which was more than the quantity of litharge used by battery manufacturers in that year. In 1934 all major uses of litharge increased except rubber manufacture.

Distribution of litharge sales, 1931–34, by industries

Industry	1931		1932		1933		1934	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Storage batteries	31,605	49.5	29,305	50.5	27,327	44.6	30,024	43.[illegible]
Insecticides	7,508	11.8	11,735	20.2	11,126	18.2	12,271	17.[illegible]
Oil refining	7,351	11.5	4,793	8.3	6,070	9.9	7,614	11.[illegible]
Ceramics	4,124	6.5	2,963	5.1	5,438	8.9	6,696	9.[illegible]
Chrome pigments	3,582	5.6	2,591	4.5	3,973	6.5	6,162	9.[illegible]
Rubber	3,032	4.7	1,921	3.3	2,875	4.7	2,466	3.[illegible]
Varnish	641	1.0	1,360	2.3	610	1.0	414	.[illegible]
Linoleum	206	.3	169	.3	106	.2	104	.[illegible]
Other	5,839	9.1	3,199	5.5	3,668	6.0	2,982	4.[illegible]
	63,890	100.0	58,096	100.0	61,193	100.0	68,733	100.[illegible]

Red lead.—The use of red lead in storage batteries increased 2[illegible] percent and in paint 22 percent in 1934 over 1933.

Distribution of red lead sales, 1931–34, by industries

Industry	1931		1932		1933		1934	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Storage batteries	13,700	53.0	10,655	56.4	12,949	58.9	15,087	58.[illegible]
Paints	9,256	35.8	6,389	33.8	7,182	32.7	8,766	32.[illegible]
Ceramics	811	3.1	467	2.5	715	3.2	595	2.[illegible]
Other	2,086	8.1	1,369	7.3	1,142	5.2	1,395	5.[illegible]
	25,853	100.0	18,880	100.0	21,988	100.0	26,743	100.[illegible]

Orange mineral.—Sales of orange mineral

Distribution of orange mineral sales, 193

Industry	1931		1932	
	Short tons	Percent of total	Short tons	Percent of total
[illegible]ak manufacture	119	42.2	58	27.4
Color pigments	114	40.4	108	50.9
Other	49	17.4	46	21.7
	282	100.0	212	100.0

Zinc oxide.—Total sales of zinc oxide de[illegible] due largely to the 7 percent decrease in sal[illegible] and the 19 percent drop in sales to the paint i[illegible] consumers. Floor coverings and textiles, [illegible]inc oxide in 1934 than in 1933 but this [illegible]offset by a large decline in sales to miscella[illegible]

Distribution of zinc oxide sales, 1931–

Industry	1931		1932	
	Short tons	Percent of total	Short tons	Percent of total
[illegible]ubber	47,972	50.1	37,679	52.1
[illegible]aints	31,357	32.8	22,369	31.0
Floor coverings and [illegible]extiles	4,605	4.0	2,837	3.9
[illegible]eramics	3,171	3.3	1,782	2.5
[illegible]ther	8,505	8.9	7,583	10.5
	95,700	100.0	72,250	100.0

Leaded zinc oxide.—This pigment is use[illegible] manufacture of paint. The quantity sold [illegible]as 9 percent less than in 1933.

Distribution of leaded zinc oxide sales, 19

Industry	1931		1932	
	Short tons	Percent of total	Short tons	Percent of total
[illegible]aints	18,292	98.5	14,072	98.4
[illegible]ubber	38	.2	26	.2
[illegible]ther	247	1.3	207	1.4
	18,577	100.0	14,305	100.0

Lithopone.—Sales of lithopone to the p[illegible] [illegible]ercent in 1934. About 8,200 tons of lit[illegible] [illegible]anufacture of titanated lithopone in 19[illegible] [illegible]ons in 1933. Sales of high-strength litho[illegible] [illegible]hereas those of regular lithopone increase[illegible]

coverings and textiles took 20 percent less and rubber 9 percent le
lithopone in 1934 than in 1933. Lithopone production capacit
was reported at 232,320 tons per year in 1934 compared with 233,32
tons in 1933.

Distribution of lithopone sales, 1930–34, by industries

Industry	1930 (short tons)	1931 (short tons)	1932 (short tons)	1933 (short tons)	1934	
					Short tons	Perce of tot
Paints, etc.	126,076	119,446	93,405	106,095	114,472	7
Floor coverings and textiles	23,056	20,780	17,001	18,472	14,811	1
Rubber	5,907	5,833	3,955	5,078	4,590	
Other	8,336	5,791	6,646	10,286	11,686	
	164,065	151,850	121,067	140,831	145,565	10

Zinc chloride.—According to the Department of Agriculture t
consumption of zinc chloride by wood-treating plants declined in 19
notwithstanding a substantial increase in the total quantity of woo
treated. From a peak of 26,000 tons (solid basis) in 1921 consum
tion of zinc chloride in this field declined to 12,000 tons in 1928, 2,50
tons in 1933, and 1,600 tons in 1934. The loss of this market is d
primarily to the fact that zinc chloride is soluble in water and ther
fore is not as effective as creosote, its principal competitor, in preser
ing wood exposed to moisture. From time to time various insolub
zinc preservatives have been developed, none of which has found
wide market. Recently a chromated zinc was introduced, b
enough time has not elapsed to gage its effect on this market for zi

Zinc sulphate.—In 1933, the latest year for which data are ava
able, 492 tons of zinc sulphate were used as a depressant in the flot
tion of lead-zinc ores. This compares with 408 tons in 1932 and 1,42
tons in 1929.

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

Lead pigments and zinc pigments and salts are manufactured fr
a variety of materials, including ore, refined metal, and miscellaneo
secondary materials, such as scrap and waste from various industri
processes. In 1934, 95.2 percent of the lead in lead pigments w
derived from pig lead, 4.6 percent from ore, and 0.2 percent fr
secondary material. For zinc pigments and salts the proportio
were 63.3 percent from ore, 21 percent from slab zinc, and 15.7 p
cent from secondary materials.

tal content of lead pigments and zinc pigments
manufacturers, 1933–34, by sources

Source	Lead in pigments
Domestic ore	6,87
Metal	143,02
Secondary material [2]	8
	149,95

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

In the following tables the source of the
acture of each pigment and salt is given
ively, either directly or indirectly, in the
litharge, red lead, and orange mineral an
anufacture of basic lead sulphate. Zinc
which considerable slab zinc is used. Or
acture of zinc oxide, leaded zinc oxide, lit
asic lead sulphate. Some secondary lead
f basic lead sulphate, and a substantial
lithopone and zinc chloride made in the Un
econdary material. There was a large i
inc drosses used in the manufacture of zi
ver 1932. The decided drop in the use of
ith 1933 was due to the sharp decline in pr
inc oxide.

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

Pigment	1933			
	Lead in pigments produced from—			Tota lead pig- ment
	Domestic ore	Pig lead	Secondary material	
White lead		60,469		60,
Red lead		20,060		20,
Litharge		56,469		56,
Orange mineral		136		
Basic lead sulphate	1,908	5,893		7,
Leaded zinc oxide	4,967		56	5,
Zinc oxide				
	6,875	143,027	56	149,

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1933–34, by sources, in short tons

Pigment or salt	1933				1934			
	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	42,110	32,784	2,848	77,742	42,804	25,371	3,355	71,530
Leaded zinc oxide	10,913	31	118	11,062	11,478		95	11,573
Lithopone	[1] 17,749		11,288	[1] 29,037	[1] 20,519		10,836	[1] 31,355
Zinc chloride		101	6,680	6,781		19	4,216	4,235
Zinc sulphate	850		864	1,714	1,530	1	411	1,942
	71,622	32,916	21,798	126,336	76,331	25,391	18,913	120,635

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

PRODUCERS AND PLANTS

The chapter on Lead and Zinc Pigments and Zinc Salts in Minerals Yearbook, 1934, page 132, contains a list of producers of the various products covered in this report, to which should be added the following producers of zinc oxide: Federated Metals Corporation, Trenton, N. J.; Metals Recovery Co., Richmond, Calif.; Monsanto Chemical Co., East St. Louis, Ill.; and Superior Zinc Corporation, Bristol, Pa.

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, appears in the following table.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1932–34, in cents per pound

Product	1932	1933	1934
Basic lead sulphate, or sublimed lead, less than car lots, barrels	5.50– 6.00	5.50– 6.00	6.25
White lead, or basic lead carbonate, dry, car lots, barrels	6.00– 6.50	6.00– 6.50	6.25– 6.50
Litharge, commercial, powdered, barrels	5.25– 6.00	5.50– 7.00	6.00– 6.75
Red lead, dry, 95 percent or less, less than car lots, barrels	6.25– 7.00	6.50– 8.00	7.00– 7.75
Orange mineral, American, small lots, barrels:			
Ex-white lead	8.75–10.75	10.25–11.75	10.75–11.50
Ex-red lead		9.00–10.50	9.50–10.25
Zinc oxide:			
American process, lead-free, bags, car lots [1]	5.75– 6.50	5.75	5.75– 6.50
American process, leaded, barrels, car lots [1]	5.75– 6.50	5.75	5.75– 6.50
French process, red seal, bags, car lots [1]	8.63– 9.75	8.63	8.38
French process, green seal, bags, car lots [1]	9.63–10.38	9.63	9.38
French process, white seal, barrels, car lots [1]	10.88–11.63	10.88	10.63
Lithopone, domestic, 5-ton lots, bags [1]	4.50	4.50	4.50
Zinc sulphide, less than car lots, bags, barrels	13.00–13.50	13.00–13.50	10.50–13.25
Zinc chloride, works:			
Solution, tanks	3.00	2.00– 3.00	2.00
Fused, drums	5.00– 5.75	4.25– 5.75	4.25– 5.75
Zinc sulphate, crystals, barrels	3.00– 3.50	2.75– 3.75	2.65– 4.50

[1] From Jan. 1 through June 3, 1932, reported as car lots; from June 4, 1932, through Dec. 30, 1933, reported as 2-ton lots.

FOREIGN TRA

Imports of lead and zinc pigments a
in 1934, and exports increased 42 perce
increased to over $400,000 compared wi
$3,000,000 in 1929. In 1933 there was
The following table shows the value
salts imported and exported for 1933–3

Value of foreign trade of the United States in 1933–34

	Im
Lead pigments:	
White lead	
Red lead	
Litharge	
Orange mineral	
Total	
Zinc pigments:	
Zinc oxide	
Lithopone	
Zinc sulphide	
Total	
Lead and zinc salts:	
Lead arsenate	
All lead compounds [1]	
Zinc chloride	
Zinc sulphate	
All zinc compounds [1]	
Total	
Grand total	

[1] Orange mineral included with red lead in 1933, but data
[2] Excluding pigments. Salts not classified separately.
[3] Figures not available.
[4] Exclusive of the value of "all zinc compounds", figures

Lead pigments and salts.—Imports
negligible proportions. The most im
lead compounds, including lead acetat

Lead pigments and salts imported for consum in short to

Year	Basic carbonate white lead	Re le
1929	98	
1930	74	
1931	68	(4
1932	29	
1933	3	
1934	15	

[4] Less than 1 ton.

[3] Figures on imports and exports compiled by Claude Gal
Bureau of Foreign and Domestic Commerce.

The principal exports are white lead, litharge, red lead, and lead arsenate. Less than 2 percent of the domestic production of white lead, red lead, and litharge was exported in 1934. Shipments of white lead to foreign countries were 49 percent higher in 1934, those of red lead were 31 percent higher, and those of litharge were 37 percent lower than in 1933. Canada took over half of the red lead and litharge exported in 1933 but only 24 percent of the 1934 total.

Lead pigments and salts exported from the United States, 1929–34, in short tons

Year	White lead	Red lead [1]	Litharge	Lead arsenate	Other lead compounds	Total value
1929	5,908	2,890	(2)	782		$1,616,927
1930	6,540	4,128	(2)	1,135		1,777,189
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	299		371,769
1934	1,561	745	972	325		457,273

[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,[1] and litharge exported from the United States, by destinations, 1931–34, in short tons

Destination	White lead				Red lead, orange mineral,[1] and litharge			
	1931	1932	1933	1934	1931	1932	1933	1934
Countries:								
Argentina	67	31	60	69	103	63	109	232
Canada	81	23	75	91	1,935	1,268	1,104	415
Netherlands	361	387	377	463	37	4		
Netherland West Indies	1	3	2	10	(2)	3	58	(2)
Panama	1	201	26	201	76	2	68	112
Philippine Islands	112	145	138	130	86	105	164	210
United Kingdom	4,235	743	73	47	233	26	17	3
Others	150	148	296	550	617	515	588	745
Total	5,008	1,681	1,047	1,561	3,087	1,986	2,108	1,717
Continents:								
North America	152	326	223	477	2,117	1,379	1,404	759
South America	83	75	150	177	223	218	210	346
Europe	4,619	1,131	479	590	490	197	213	222
Asia	123	148	141	(2)	217	170	201	40
Africa	30	(2)	53	167	40	21	80	118
Oceania	1	1	1	150	(2)	1	(2)	222

[1] Orange mineral is not included in this group in 1934. Data not available.
[2] Less than 1 ton.

Zinc pigments and salts.—Imports of zinc oxide and lithopone declined 50 and 30 percent, respectively, in 1934. Of the zinc oxide, 41 percent came from the United Kingdom, 26 percent from France, and 21 percent from Belgium, and the Netherlands supplied 98 percent of the lithopone. Germany supplied 88 percent of the zinc chloride imported in 1934.

Zinc pigments and salts imported for consumption in short tons

Year	Zinc oxide		Litho-pone
	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	5,596
1934	1,204	64	3,927

Exports of zinc oxide and lithopone i
respectively, due largely to increased shi
North American countries. Canada wa
took only 6 percent as much zinc oxi
lithopone as in 1929.

Zinc pigments and salts exported from the Uni

Year	Zinc oxide	Litho-pone	Zinc salts	Total value	Ye
1929	17,638	4,556	1,711	$2,919,140	1932
1930	10,753	3,005	1,558	1,956,085	1933
1931	5,131	3,821	1,011	1,146,395	1934

[1] Zinc salts not separately recorded.
[2] Exclusive of value of zinc salts.

Zinc oxide and lithopone exported from the Unite in short tons

Destination	Zinc oxide		
	1931	1932	1933
Countries:			
Argentina	171	79	16
Canada	2,818	740	286
Cuba	58	23	22
France	1	4	5
United Kingdom	1,523	97	36
Others	560	318	357
Total	5,131	1,261	722
Continents:			
North America	2,998	904	437
South America	217	94	39
Europe	1,713	116	72
Asia	93	61	80
Africa	8	5	3
Oceania	102	81	91

[1] Less than 1 ton.

shipments eventuate. However, really substantial deposits of tantalite associated with cassiterite have been discovered apparently by various mining companies in the Belgian Congo. A new mineral, thoreaulite, containing 72 to 74 percent Ta_2O_5 and 20 to 22 percent SnO_2, is described [35] in connection with this new occurrence, and the relatively high tin content undoubtedly will handicap economical working. A deposit in Uganda has also been described,[36] and additional discoveries have been reported in the U. S. S. R. (Russia), this time in the Dzerul Hills, Georgia.

TELLURIUM

In 1934, as in 1933, tellurium was produced by three companies. For several years the Bureau of Mines was not at liberty to publish data covering production of tellurium, but the figures showing the quantity of tellurium sold by producers in the United States can now be released, and sales for 1930 and 1932 to 1934, inclusive, as given n the following table, show an extraordinary increase.

Tellurium sold by producers in the United States, 1930–34

Year	Sales			Year	Sales		
	Pounds	Value			Pounds	Value	
		Total	Average			Total	Average
1930	4,717	$7,906	$1.70	1933	11,980	(1)	(1)
1931	(1)	(1)	(1)	1934	21,027	(1)	(1)
1932	1,567	(1)	(1)				

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

Probably the leading development that affected tellurium in 1934 was gradual expansion in practical use of tellurium-lead. Both in England and the United States this material has passed the experimental stage and is arousing great interest in the chemical industries, particularly for equipment holding sulphuric acid. Tellurium is easily added to lead and is retained by lead up to high temperatures. Such obnoxious toxic effects as may accompany too intimate contact with tellurium compounds can be avoided by the same precautions necessary to avoid harmful lead fumes. The amount of tellurium in tellurium-lead is surprisingly small—less than 0.1 percent—but it produces marked improvement in tensile strength and corrosion resistance, refining the grain and raising the temperature of recrystallization (or at least retarding it to an extraordinary degree), enabling the material to grow harder and stronger after deformation or "working." The superiority of tellurium-lead, both in increased tensile strength and corrosion resistance, is even more pronounced at elevated temperatures, and it is for higher temperature operations (say 100° C. or over) that tellurium-lead will be particularly serviceable. A storage-battery plate of tellurium-strengthened lead, preferably with 0.05

[35] Buttgenbach, H., Minerals of Belgian Congo: Ann. Soc. Belg. Bull. 56, 1932-33, pp. 327-331; Chem. Abs., vol. 28, no. 21, Nov. 10, 1934, p. 6658.
[36] Combe, A. D., The Migera Tantalite Deposit: Uganda. Geol. Surv. Dept., Ann. Rept., 1933, Entebbe, 1934, p. 62.

percent tellurium and 6 percent antim
England.[37]

The electrical conductivity of telluriu
tional study, particularly as regards the
impurities.[38] Of possible commercial in
that covers the use of tellurium as re
refrigerators, marking recognition by ele
ment makers of the practical value of th
electrical resistance characteristic of this
lurium are in the Tainton process of zinc r
ing, and (as chloride) for dipping silver
Tellurium is described by a leading cable
for processing rubber to make a tough
proves the rubber, toughens it, enables
and greatly increases the life of the cabl

Prices.—New York quotations for tel
nally unchanged at $2 a pound for severa
ment began to have real commercial app
ever, the previous quotation of 15s. to 16s
vanced to 17s. 6d. ($4.32) in October 1934
duty paid); these figures, however, are pure
said to obtain the material at substantiall
parable to those quoted in the United S
the largest producer although the copp
Ontario, began to recover tellurium in
countries may be expected to do likewise
to sufficiently large proportions.

Imports.—Domestic supplies of tellu
exceed actual demand, and exports are
statistics are lacking, imports of telluri
nificant or nonexistent.

The industry in foreign countries.—The
far the largest producer of tellurium, bu
pean smelting countries likewise are pa
recovery of the element. In Canada, tel
Cliff, Ontario, as a byproduct in the refi
the plant began operations in October
tellurium were sold during the year.

TITANIUM

In 1934 ilmenite and rutile were prod
Corporation in Nelson County, Va., an
of America in Hot Springs County, Ark
by the Southern Mineral Products Cor
Va. The Bureau of Mines is not at l
figures, but the total output was substa
years. Some of the 1934 production we
ilmenite were equivalent to only abou
output, but more than 70 percent of the

[37] Singleton, William, and others and Goodlass Wall & L
June 8, 1934.
[38] Cartwright, C. H., and Haberfeld, M., Conductivity o
25, 1934, p. 287.
[39] Chemistry and Industry (London), Selenium and Tell
no. 28, July 13, 1934, pp. 616–617.

The principal use of titanium continues to be in the manufacture of pigments. The titanium pigments—pure titanium dioxide, titanium-barium pigment, and titanium-calcium pigment—have been improved and perfected steadily but no material change was made in methods of manufacture, composition, or pigment characteristics during 1934. The Titanium Pigment Co. (subsidiary of the National Lead Co.) made several improvements in its St. Louis factory and was constructing a large new plant at eastern seaboard, the site finally selected being at Sayreville, N. J. This new plant is reputed to cost $4,300,000 and will probably have a daily capacity of 30 tons and employ 200 persons. Du Pont's subsidiary, Krebs Pigment & Color Corporation, is expanding its productive capacity and a further increase in the national total will result from the construction of still another new plant at Baltimore, which will be operated by the American Zirconium Corporation, a jointly owned subsidiary of the Glidden Co. and the Metal & Thermit Corporation. During 1934 it was estimated that 32,000 tons of titanium dioxide was produced in this country.

Ferrotitanium and the titanium alloys are produced in the United States by three companies, the Titanium Alloy Manufacturing Co., with plant at Niagara Falls, N. Y. (ferrocarbon and low-carbon grades), the Vanadium Corporation of America, with plants at Niagara Falls, N. Y. (ferrocarbon grades), and Bridgeville, Pa. (low-carbon grades); and the Metal & Thermit Corporation, with plant at Jersey City, N. J. (carbide-free grades). Substantial increases in sales were reported again in 1934, but figures cannot be published without revealing confidential information.

Metallurgical uses of titanium as yet have not accounted for more than a rather small percentage of the consumption of the element but nevertheless are important and growing more so. Recently its use in the alloy field has tended sharply upward. Even 3 or 4 years ago the role of titanium in steel manufacture was mainly that of deoxidizer and general scavenger, but by proper furnace technique it can now be employed for its alloying effect. The property of titanium chiefly responsible for its expanding use today as an alloying element in steel is its strong affinity for carbon, coupled with the comparatively low solubility of titanium carbide in solid steel. Carbon is undesirable in some steels, especially chrome-nickel stainless steels, but is both difficult and expensive to keep out. Often it may be simpler and more economical to neutralize its action by adding a little free titanium. This action of titanium not only avoids unduly prolonged furnace treatment to remove carbon but also permits the use of somewhat higher-carbon grades of ferrochrome and other alloys. By holding the titanium content at 5 to 7 times the carbon content, thereby in effect eliminating carbon from the picture, resistance to corrosion—particularly intergranular corrosion—is much improved and (another advantage) the steel is softer and machinable. The increased workability imparted by titanium is due to the elimination of age-hardening effects, but titanium itself may produce age-hardening if a considerable excess is added over that required for carbide control. In cast iron titanium closes the grain and, curiously enough, acts as a graphitizer. Recent work on titanium additions to nonferrous alloys, particularly copper and aluminum alloys, is expected to result in marked expansion in the use of this element in those fields.

A new high-speed steel has been pa
Braid, of the Metal & Thermit Corpor
which contains titanium instead of
18-percent tungsten, 4-percent chrom
1.5 percent titanium replacing the mo
nium is entering more and more as
Other patent specifications relate to
tions, magnet steels, and a group of c
containing substantial amounts of tita
with the possible extensive use of titani
be mentioned that certain of these alloy
addition of special alloys, as titanium c
titaniferous materials in the same bath

Titanium dioxide has other uses tha
Recently it has been advocated for use
toilet preparations and for reducing
process), as well as more extensively
ceramic products. New patents coveri
titanium pigments continue to appear
rutile (instead of anatase) by fusing ti
caustic soda melt at 700° C. is descri
1922328) and Richter devised a proce
making titanium dioxide or purifying
ment. A 1933 patent (U. S. Patent
ment Co. covers treatment of rutile by
or carbonate of potash to form an acid s
preliminary to pigment manufacture
(U. S. Patents 1931380–1931381) issu
Corporation are of interest, inasmuch
tetrachloride.

Prices.—No changes in prices of le
ments were made in 1934. For calciu
in bags, 6 cents per pound was asked in
shipments under 20 tons. For pure
the carlot rate was still 17 cents, rising
per pound on l. c. l. shipments, accord
for Pacific coast deliveries averaged ab

The contract price for standard fer
15 to 18 percent titanium and 6 to 8
$137.50 per short ton. From 1910 to
held unchanged at $200 a ton, but it w
$150 in 1930, and to $137.50 in 1931,
mained. London quotations likewise w
as in the latter part of 1933, small-lot
long ton. In the United States the car
35 cents per pound of alloy for the s
$1.37 per pound of contained titanium
the London quotation for 23- to 25-pe
mained at 9d. per pound.

Imports.—The imports of ilmenite,
after year, suddenly jumped in 1934
$356,208 compared with 38,610 tons
Whereas the steady increases reporte
afforded a rough index of the rapidl
pigments in the United States the 1934

amount of material that went into storage piles in anticipation of enlarged production along the Atlantic seaboard. In recent years the total importation has come from British India.

Rutile imports likewise increased sharply, rising to 309,221 pounds valued at $7,350 compared with 157,658 pounds valued at $3,737 in 1933. The average value of these imports, all from Brazil, was under 3 cents per pound, whereas when the imports came from Norway the average foreign market value was reported several times larger; in 1931, for example, it exceeded 9 cents, and in 1930 it was over 15 cents.

Imports of ferrotitanium and other titanium alloys, mostly from Italy and Great Britain, are insignificant, amounting in 1934 to only 3,240 pounds valued at $434 (all from the United Kingdom).

Titanium ores imported for consumption in the United States, 1929–34

Year	Ilmenite		Rutile	
	Long tons	Value	Pounds	Value
1929	22,386	$104,887	11,200	$1,463
1930	22,298	150,406	6,720	974
1931	29,857	144,951	2,000	189
1932	33,491	231,652	176,395	4,508
1933	38,610	196,211	157,658	3,737
1934	71,710	356,208	309,221	7,350

THE INDUSTRY IN FOREIGN COUNTRIES

Australia.[40]—Plans for development of Byron Bay deposits of black sand include possible production of rutile and ilmenite as well as zirconium minerals. These deposits, evidently extensive, are situated in New South Wales a little over 100 miles south of Brisbane and have been worked spasmodically for tin and gold, but a new company, Zircon Rutile, Ltd., has been organized to erect a plant capable of treating 15,000 to 20,000 tons of these sands annually. A published analysis indicates an extraordinary degree of natural concentration, showing 64 percent zircon, 18 percent rutile, 9 percent ilmenite, 4 percent cassiterite, 3 percent monazite, and only 2 percent waste. The treatment method is reported to start with "flotation" of the zircon, followed by magnetic separation of the residue. Obviously, zircon is the principal object of this enterprise and preliminary estimates place operating costs at £2 5s. 3d. per ton of zircon, which it is hoped can be sold at £8 a ton at a rate of 7,500 tons a year, indicating an annual profit of £13,000 on the basis of an initial investment of around £24,500.

British India.—The Travancore beach sands were worked for monazite as early as 1911, but it was not until 1922 that ilmenite was saved and exported. Recently ilmenite has become the main product, and monazite is retreating to decidedly minor importance, production of the titanium mineral having increased steadily except for a slight set-back in 1933 which, if one may judge from imports of Indian ilmenite into the United States, was overwhelmingly off-set by an extraordinary increase in 1934. Zircon also accompanies the ilmenite; it, too, has become increasingly important, although on a more moderate scale; production of this mineral r
£3,018 compared with 490.6 tons valu
age value of the ilmenite production
been £1 a long ton, and the TiO_2 co
cent; these two factors doubtless expl
tually has displaced all other water-bo

Canada.—Shipments of titanium or
2,023 short tons valued at $14,161, a
St. Paul deposits in Quebec and was
No production was reported in 1933.
by the Canadian paint industry is inc
pounds valued at $128,969 in 1933
valued at $89,761 in 1931.[41] Titanite
silicate mineral, has never served an
though it contains about 40 percent T
therefore, that about 40 tons of this m
view to finding uses for it. The min
North Crosby, Leeds County, Ontari
tals in a granite pegmatite dike.

France.[42]—Certain volcanic rocks i
Alps contain titanium minerals, but
or rutile have been discovered. Atte
titanium dioxide content of French b
4 percent and averages 3.25 percent
mud, a typical analysis of which shov

	Percent
Al_2O_3	14 to 16
Fe_2O_3	52 to 54
SiO_2	10 to 11

It is already proposed to utilize thes
they are first washed with sulphuric
tic soda which would saponify oil, a
dioxide in the final product may cont
This resource, formerly not utilized,
of titanium oxide annually on the b
sumption.

Germany.—Titanium pigments ar
Titan-Gesellschaft m. b. H., an I. G
Cologne. Production data and ever
available, but it is known that Ger
sources of these pigments and that ex
of those of the previous year.

United Kingdom.—In 1933 the Na
a subsidiary of B. Laporte, Ltd., op
at Luton, and in 1934 another facto
completed and commenced product
Tees, Durham. The new concern ha
the National Lead Co. of the Unite
the Imperial Smelting Corporation,
tries, Ltd., and Goodlass Wall & Lea

[40] Chemical Engineering and Mining Review, Zircon and Rutile from Black Sands: Vol. 26, no. 310, Melbourne, July 5, 1934, p. 388.

[41] Canada Department of Trade and Commerce, Dom
Canada (Preliminary Report): 1934, p. 24.

[42] *L'Industrie Chimique*, La Bauxite mineral de titan

U. S. S. R. (Russia).—It is reported that the titanium dioxide department of the Yaroslavl white lead works came into production in February 1934; 5 tons monthly were being produced at first and the anticipated capacity is only 30 tons monthly.

World production of titanium minerals, 1933–34

[Compiled by L. M. Jones, of the Bureau of Mines]

Mineral and country	1933			1934		
	Ore produced	Content of TiO_2	Value [1]	Ore produced	Content of TiO_2	Value [1]
Ilmenite:	*Metric tons*	*Percent*		*Metric tons*	*Percent*	
Australia: Tasmania	559	[2]	$4,234	[2]	[2]	[2]
Canada (Quebec)				1,835	18–25	$14,303
India (Travancore)	44,080	54	183,810	[2]	[2]	[2]
Norway	23,213	44	140,000	[2]	[2]	[2]
Portugal	645	50	2,311	434	50	[2]
Senegal [3]	310	47	[2]	[2]	[2]	[2]
United States	[4]	[4]	[5]	[4]	[4]	[4]
Rutile:						
Brazil [3]	96	[2]	3,041	[2]	[2]	[2]
Norway [6]	56	90–93	13,500	[2]	[2]	[2]
United States	[4]	[4]	[4]	[4]	[4]	[4]

[1] Values as officially reported converted to United States currency at the annual average rate of exchange as published by the Federal Reserve Board.
[2] Data not available.
[3] Exports.
[4] Exports during first 11 months of year; complete data not yet available.
[5] Bureau of Mines not at liberty to publish figures.
[6] Concentrates.

ZIRCONIUM

No zirconium minerals have been produced in the United States since 1927, although a small quantity of zircon was recovered in 1928 from old tailings. An output of about 1,000 pounds was recorded as early as 1869, and sporadic contributions have been made at intervals during subsequent years, but the only substantial supplies obtained from domestic sources were the result of the short-lived operations of Buckman & Pritchard, Inc., who produced a considerable amount of zircon as a joint product of their ilmenite and rutile operations at Pablo Beach or Mineral City, Fla. This enterprise was abandoned in 1929 after furnishing a maximum of 3,646 short tons of zircon in 1927. Since then the fluctuating requirements of the United States have been supplied by imports, chiefly from Brazil and British India.

An ever-growing demand for zirconium has stimulated the search for new deposits, and a number of new developments have occurred during the last several years, including those in Australia and British India, which are described briefly in the section of this chapter on titanium. Of special interest in connection with an Australian project is the application of flotation as a means of separating a high-grade concentrate of zircon after, or even in advance of, magnetic treatment. An abstract of the Corbett patent specifications [43] indicates that the separation can be effected from all the ordinary constituents of a black-sand concentrate—rutile, monazite, ilmenite, garnet, quartz, kyanite, etc. The oiled-zircon particles may not float on the surface of the pulp, in which case they may be separated from unoiled minerals

[43] Corbett, Miles A., Concentrating Zircon Ores: British Patent 406018, Feb. 12, 1934; Chem. Abs., vol. 28, no. 14, July 20, 1934, pp. 4362–4363.

by treatment on shaking tables or jigs
tion process). Assuming that selective
it may afford a means of rendering ec
supply from black sand deposits in var
ing the United States. Zirconium-b
the Straits Settlements were receiving
In certain Japanese deposits a number
xenotime, are associated with zircon in
high percentages of zircon also are said
the coast of Kenya (Africa), represent
formations.

Zirconium is generally considered r
mercial deposits virtually are limite
naturally concentrated black-sand ac
places in the world. It is nevertheless a
being one of the commonest accessor
igneous rocks, especially the more
commonly agreed that zirconium c
(1 part in 5,000) of the earth's crust, b
examining analyses (by X-ray spectros
conclude that the proportion is large
tains 1 part zirconium in 3,000, volc
effusive rocks 1 part in 4,500, where
only 1 part in 12,000. The element
abundant than nickel and several tin
called "common metals", copper, zinc

Prices.—Quotations for zircon ore,
board, after remaining unchanged fo
net ton (in carloads), were advanced
Crude granular zircon, f. o. b. Suspens
remained unaltered at $70 a ton wit
milled or powdered material. Zircon
various forms likewise remained unch
reductions were made in the price of si
Zr, 47 to 52 percent Si) and zirconiu
Zr, 39 to 43 percent Si), but the ear
March 1934, the former alloy being q
cents a pound and the latter at $97.
mercially pure zirconium powder has
pound since March 1933, but this pric
lots the price has remained at $6.

Uses.—Zirconium metal is used in
munition primers. Ferrozirconium o
to steel are advocated especially wh
excessive sulphur—a condition that n
than in the United States. Zirconiu
an alloy constituent, generally in ra
nonferrous alloys, including aluminu
plug electrodes, and several sintered-
include zirconium. Zirconium dioxi
its high melting point and resistance t
lies, combined with low porosity, low

[44] Hevesy, G. von, and Würstlin, K., The Natural Occu
vol. 216, 1934, pp. 305–311; Chem. Abs., vol. 28, no. 11, Ju