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LEAD[1]

By T. H. Miller and A. L. Ra

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GENERAL SUMMARY

The lead industry in 1941 was called upo unprecedented demand. Lead was not only metal in direct military applications specif defense program but as a substitute to help other nonferrous metals. As the result of th showed moderate gains over 1940; but thes quate, despite the continued flow of metal from foreign sources, and by October lead ernment control.

The output of refined primary lead from d was 7 percent above that in 1940 and the larg Production from domestic ores increased 9 foreign ores remained virtually unchanged fr lished in 1940. The estimated industrial use ary, and antimonial) rose 34 percent and w record established in 1929. As production year-end stocks at domestic refineries declin secutive year. This condition was balanced ponding rise in consumers' inventories, which consumption was greater than the amount a lead at New York advanced from 5.50 cents 5.85 cents in April, at which point the quot the rest of the year; the average price for the cents in 1940 to 5.79 cents in 1941.

[1] This report deals primarily with the smelting, refining, and con full details of mining operations, see separate reports issued for the v

Salient statistics of the lead industry in the United States, 1925–29 (average) and 1937–41, in short tons

	1925-29 (average)	1937	1938	1939	1940	1941
Production of refined primary lead:						
From domestic ores and base bullion	660,525	443,142	331,964	420,967	433,095	470,817
From foreign ores and base bullion	122,104	24,175	51,705	63,068	100,114	100,450
	783,029	467,317	383,669	484,035	533,170	570,967
Recovery of secondary lead	280,000	275,100	224,900	241,500	260,346	397,416
Imports: [1]						
Lead in pigs, bars, and old	4,592	4,903	3,235	7,139	151,568	[2] 179,179
Lead in base bullion	95,747	1,800	15,206	48,902	19,624	[2] 23,631
Lead in ores and matte	40,008	34,103	45,370	30,842	111,300	[2] 58,082
Exports of refined pig lead	98,048	20,091	45,806	74,392	[3] 49,079	[2] 13,494
Lead remaining in bonded warehouse at end of period	136,969	60,131	87,811	79,215	211,876	[4] 153,289
Refined primary lead available for consumption	690,916	449,464	339,708	415,031	633,989	(5)
Estimated consumption of primary and secondary lead	900,250	678,700	546,000	667,000	782,000	1,050,000
Prices:						
New York:						
Average for year..cents per pound	7.47	6.01	4.74	5.05	5.18	5.79
Quotation at end of year....do	6.25	4.75	4.85	5.50	5.50	5.85
London average.....do	5.87	5.15	3.33	[6] 3.09	(7)	(7)
Mine production of recoverable lead	664,230	464,892	369,726	413,979	457,392	461,426
World smelter production of lead	1,850,000	1,851,000	1,878,000	1,919,000	(5)	(5)

[1] Data include lead imported for immediate consumption plus material entering the country under bond.
[2] Figures cover January to September, inclusive.
[3] Includes 25,324 tons of foreign refined lead re-exported, according to American Bureau of Metal Statistics; official figures not available.
[4] September 30.
[5] Figures not available for publication.
[6] Average for 8 months; London Metal Exchange dealings suspended for duration of war.
[7] Official maximum price fixed by British Ministry of Supply at £25 per long ton.
[8] Data not available.

Record quantities of lead continued to be received from abroad, largely in the form of refined metal principally from Mexico, but also in greatly increased tonnages from Canada, Australia, and Peru. Government stock piles of foreign lead purchased through the Metals Reserve Company were drawn on to bridge the gap between production and shipments; as a result, the large quantity of lead that had accumulated in bonded warehouses by the end of 1940 was notably depleted during the first 9 months of 1941.

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

National defense activity.—All defense requirements necessitating the consumption of lead were met in 1941, including direct use in ammunition and in important indirect secondary military uses, such as batteries, paints, tetraethyl lead, and chemicals. One of the largest jobs for lead was in substitution for other metals, including aluminum, copper, zinc, and tin which were more important for war purposes and a great deal less abundant. Very little concern was felt as to lead supplies during the first part of 1941, and only nominal surveillance over the lead industry by the Production Division of the Office of Production Management was necessary. Following a previously issued warning, Leon Henderson, Commissioner of Price Stabilization of the Advisory Commission to the Council of National Defense, on April 5, 1941, requested that there be no further increase in the price of lead. This announcement, with its accompanying threat of ceiling prices, halted the upward trend, and no further change occurred during 1941.

Following the rapid expansion of lead consumption in early 1941 it was soon apparent that a shortage threatened, and, to conserve

supplies and prevent lead from getting unto unfri
was placed under export control as of March 2
included lead in ore, matte, pigs, bars, and manu
6 was extended to include lead pigments.

On May 1, 1941, General Metals Order 1, de
ventory accumulation of lead and various oth
priority control, was issued by the Office of Proc
It remained in effect until October 4, when all su
ing domestic and imported, were placed under
The new control, provided for in Order M-38
allocation that previously had been restricted
lead purchased and held by the Metals Res

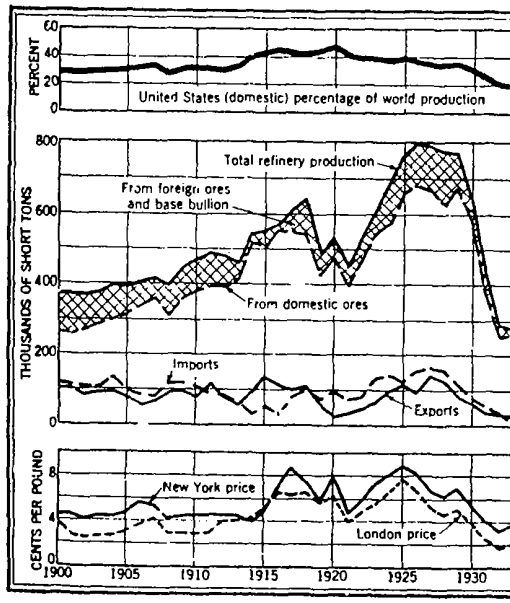

FIGURE 1.—Trends in the lead industry in the United States, 1900–1941. bullion, pig lead, and scrap; exports include pigs, bars, and scrap lead benefit of draw-back.

emergency pool was set up to take care of special
23 the Division of Priorities of the Office of Pro
ordered refiners of lead to set aside 15 percen
production for allocation from this pool. The
ordered set aside for December and for each succ
up to the time this review was written (June 25)

In an effort to ease the supply situation, an a
lead producers and miners by the Office of Pro
early in November, asking them to increase prod
18 the Office of Production Management, jointl
Price Administration, announced a two-point p
urgent additional demands for copper, lead, an
active entry into the war. With regard to lead,
an increase in the price at New York to a ceiling

and a payment, through the Metals Reserve Company, of a premium price of 9.25 cents for lead produced in excess of quotas based upon 1941 output. The premium-price plan was made effective as of February 1, 1942, for 2½ years.

DOMESTIC PRODUCTION

Pig lead is produced at primary plants that treat mainly ore and at secondary plants that treat scrap exclusively. Both types of plants may produce refined lead or antimonial lead. Because of the large quantity of battery scrap treated at secondary smelters, their output comprises chiefly antimonial-lead alloys. Figures for production of refined lead at secondary plants are shown in the section on Secondary Lead.

The following table shows production of refined lead and antimonial lead at primary refineries from 1937 through 1941.

Refined lead and antimonial lead produced at primary refineries in the United States, 1937–41, in short tons

Year	Refined lead				Antimonial lead
	From domestic ores and base bullion	From foreign ores and base bullion	From scrap	Total	
1937	443,142	24,175	29,986	497,303	27,824
1938	331,964	51,705	24,800	408,469	24,123
1939	420,967	63,068	29,011	513,046	21,995
1940	433,065	100,114	16,588	549,767	29,762
1941	470,517	100,450	13,454	584,421	40,237

PRIMARY LEAD

Refinery production.—Production of refined primary lead increased 7 percent in 1941 but was only 73 percent of the 1925–29 average (783,629 tons). Output from domestic ores and base bullion gained nearly 9 percent; production from foreign ores and base bullion remained virtually unchanged, with an increase of less than 1 percent from the high level attained in 1940, and was considerably less than the average (123,104 tons) for the period 1925–29.

Refined primary lead produced in the United States, 1937–41, by classes and sources

Year	Production (short tons) by—						Total production [1]		
	Class			Source			Short tons	Value	
	Desilverized lead [1 2]	Soft lead [1]		From domestic ores and base bullion	From foreign ores	From foreign base bullion		Average sales price per pound	Total calculated value
		Desilverized	Undesilverized						
1937	272,051	55,317	139,949	443,142	23,393	782	467,317	$0.059	$55,143,000
1938	243,891	31,986	107,792	331,964	32,862	18,843	383,669	.046	35,298,000
1939	280,356	65,340	138,330	420,967	24,652	38,416	484,035	.047	45,499,000
1940	336,450	43,400	153,323	433,065	83,663	16,551	533,179	.050	53,318,000
1941	366,385	39,872	164,710	470,517	74,166	26,284	570,967	.057	65,090,000

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

Sources of primary lead.—Of the total refined p
in 1941, 82 percent was derived from domestic
and 18 percent from foreign. Production from
11 percent from the all-time record establish
refined from foreign bullion advanced 59 per
sources of lead from domestic ores are given i
Production.

Refined primary lead produced in the United States, 1936–

Source	1936	1937	1938
Domestic ore and base bullion	387,698	443,142	331,964
Foreign ore:			
Australia	172	3,088	7,320
Canada	2,277	5,343	3,662
Europe	1,133	388	14
Mexico	1,486	3,836	9,745
South America	3,883	8,497	9,887
Other foreign	2,450	2,241	2,334
	11,401	23,393	32,862
Foreign base bullion:			
Mexico	57	782	18,268
South America			
Other foreign			575
	57	782	18,843
Total foreign	11,458	24,175	51,705
Grand total	399,156	467,317	383,669

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

Several lead-smelting plants handle scrap
Production data from such plants are summar
section and discussed in detail in the chapter on
Nonferrous. A large quantity of hard-lead scr
primary smelters and refineries; the production
such plants is shown in the following table.

Antimonial lead produced at primary lead refineries in th

Year	Production (short tons)	Antimony content		Lead co
		Short tons	Percent	From domestic ore
1937	27,524	2,579	9.4	7,833
1938	24,123	2,809	11.6	6,759
1939	21,995	2,031	9.2	4,117
1940	29,762	2,944	9.9	7,364
1941	40,237	3,510	8.7	14,852

SECONDARY LEAD

As previously stated, some scrap lead is treated at primary plants, but the greater part is refined at a large number of plants that operate exclusively on secondary materials. Secondary lead is recovered in the form of refined lead, antimonial lead, other alloys, and chemicals. Recovery at primary and other plants in 1940 and 1941 is shown in the following table. Secondary lead recovered in 1941 totaled 53 percent more than in 1940 and was equivalent to 84 percent of the domestic refined primary lead output. Further details appear in the chapter on Secondary Metals—Nonferrous.

Secondary lead recovered in the United States, 1940-41, in short tons

	1940	1941
As refined metal:		
At primary plants	16,588	13,454
At other plants	42,992	61,810
	59,580	75,264
In antimonial lead:		
At primary plants	16,431	13,862
At other plants	110,256	192,660
	126,687	206,522
In other alloys [1]	74,079	115,630
Grand total:		
Short tons	260,346	397,416
Value	$26,034,600	$45,305,400

[1] Includes some lead in chemical compounds.

LEAD PIGMENTS

Lead pigments manufactured in 1941 contained 273,315 tons of lead—a 28-percent increase above 1940. Of the 248,674 tons of lead in pigments derived from refined pig lead, litharge contained 45 percent, white lead 35 percent, red lead 19 percent, and sublimed lead, leaded zinc oxide, and orange mineral 1 percent. Leaded zinc oxide and sublimed lead are the principal pigments of which the lead content is derived from ores. Details of production and consumption of lead pigments are given in the chapter on Lead and Zinc Pigments and Zinc Salts.

Lead in pigments produced in the United States, 1937-41, by sources, in short tons [1]

Year	Lead in pigments from—				Year	Lead in pigments from—			
	Ore		Metal	Total		Ore		Metal	Total
	Domestic	Foreign				Domestic	Foreign		
1937	17,363	.....	204,961	[2] 222,451	1940	16,869	.....	196,235	213,104
1938	12,025	.....	163,815	175,840	1941	23,951	290	248,674	[3] 273,315
1939	15,171	.....	200,390	215,561					

[1] Includes also lead recovered in leaded zinc oxide.
[2] Includes 127 tons from scrap.
[3] Includes 400 tons from scrap.

MINE PRODUCTION

Mine production of lead showed an adv
States—Western, Central, and Eastern—
during 1941 was only about 1 percent. T
increases amounted to 1,577 tons in the We
1,775 tons in the Central States, and 682 to
Lead production from Southeastern Missou
decline of 5,551 tons, whereas output fro
amounted to 41,080 tons, an advance of 5,7
homa and Kansas more than offset a loss fro
in 1941. Idaho continued to be the leading
States group and was followed again by Uta
from Idaho was only a few tons more than
from both the other States was less. The
is explained chiefly by decreases in output
& Lark property and the National Tunnel
(operations ceased about September 1941),
district. The principal factors causing the d
the production drop from the Jack Waite m
April 1941, of the Comet-Gray Eagle gro
15,638 tons of recoverable lead in 1941, the
history of the State. In Colorado the produ
tons and in Nevada 9,623 tons; both total
figures, as was also true for New Mexico a
tional details of production by mines, distr
found in the State chapters.

*Mine production of recoverable lead in the United S
1937-41, by States, in short*

State	1925-29 (average)	1937	19
Western States and Alaska:			
Alaska	982	823	
Arizona	9,743	12,364	10
California	2,070	1,186	
Colorado	30,112	9,786	9
Idaho	141,610	103,711	92
Montana	18,871	17,957	9
Nevada	9,807	9,347	4
New Mexico	6,730	6,512	4
Oregon	6	109	
South Dakota	21	.....	
Texas	213	396	
Utah	149,509	89,458	65
Washington	1,323	2,830	4
	370,997	254,468	202
Central States:			
Arkansas	38	40	
Illinois	552	186	
Kansas	26,121	16,008	15
Kentucky	135	89	
Missouri	202,240	157,631	122
Oklahoma	58,306	29,840	21
Wisconsin	1,746	1,091	
	289,137	204,885	158
Eastern States:			
New York			
Tennessee	4,096	5,539	7
Virginia			
North Carolina			
	4,096	5,539	7
	664,230	464,892	369

Mine production of recoverable lead in the principal lead-producing districts of the United States, 1937–41, in short tons

District	State	1937	1938	1939	1940	1941
Southeastern Missouri region	Missouri	153,205	118,870	153,522	169,893	164,342
Coeur d'Alene region	Idaho	96,505	82,274	81,699	95,609	95,529
Joplin region	Kansas, Southwestern Missouri, Oklahoma	50,274	39,400	44,176	35,311	41,080
Bingham	Utah	45,233	41,334	36,842	37,857	34,513
Park City region	do	22,417	7,258	11,631	19,749	19,094
Tintic	do	10,198	9,605	8,618	6,536	9,436
Butte	Montana	5,780	204	4,708	8,859	8,630
San Juan Mountains	Colorado	4,998	5,885	4,402	7,323	8,073
Ploche	Nevada	4,759	3,214	2,964	5,520	6,822
Harshaw	Arizona	984	149	2,287	4,581	5,541
Warm Springs	Idaho	4,004	7,370	5,565	5,050	5,234
Rush Valley	Utah	6,410	4,619	3,422	4,760	4,186
Central	New Mexico	2,281	340	2,941	3,245	3,903
Metaline	Washington	2,644	4,009	3,509	2,495	3,819
Austinville	Virginia	(2)	(2)	(2)	[3] 2,285	3,266
Eagle	Montana	4,812	4,301	3,252	4,108	3,204
Hog Heaven	do	808	1,214	2,767	3,588	2,826
Wallapai	Arizona	2,489	4,004	703	2,304	2,403
Old Hat	do	794	1,919	1,861	1,908	2,173
St. Lawrence County	New York	(2)	(2)	(2)	1,973	2,105
Red Cliff	Colorado	580	933	1,137	1,412	1,719
Montana	Montana	218	212	293	955	1,601
Port Hill	Idaho	519	291	1,111	1,837	1,537
Smelter	Montana	1,178	710	1,256	1,363	1,327
Ophir	Utah	3,307	2,013	6,050	5,354	1,457
Upper Mississippi Valley	Iowa, Northern Illinois, and Wisconsin	1,091	320	388	453	1,346
Leadville	Colorado	2,100	1,222	1,088	794	1,113
Bisbee (Warren)	Arizona	1,018	14	120	692	970
Banner	do					897
Cataract	Montana	1,946	1,326	1,672	1,904	356
Tombstone	Arizona	315	315	290	276	168
Flint Creek	Montana	1,511	113	218	119	114
Tybo	Nevada	2,439		14	27	20
Oro Blanco	Arizona	3,864	4,150	3,568		1
Willow Creek	New Mexico	3,852	4,277	1,800		

[1] Corrected figure.
[2] Bureau of Mines not at liberty to publish figures.
[3] Total for Virginia but almost entirely from Austinville district.

STOCKS

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

Lead stocks at end of year at smelters and refineries in the United States, 1937–41, in short tons

	1937	1938	1939	1940	1941
Refined pig lead	119,837	102,489	52,783	32,458	15,977
Antimonial lead	9,294	13,413	5,994	8,468	4,223
	129,131	115,902	58,777	40,926	20,199
Lead in base bullion—					
At smelters and refineries	10,959	18,693	10,337	9,166	8,894
In transit to refineries	2,219	2,339	3,521	3,457	2,215
In process at refineries	14,413	16,690	15,958	18,141	17,709
	27,591	37,722	29,816	30,764	28,818
Lead in ore and matte and in process at smelters	52,081	56,332	59,486	71,722	51,448
	208,803	209,956	148,079	143,412	100,149

During 1941 the excess of shipments o
generally decreasing inventories for the ye
antimonial lead at refineries, which totaled
at the end of 1940, rose to 47,200 tons by
peak for 1941—but this initial gain was fo
a low of 10,700 tons by the end of October
months, increased production more than
shipments, but refinery inventories (which
at the end of 1941) were only 49 percent o
of 1940. Stocks of lead in ore and matte
in base bullion at smelters and refineries
process at refineries were 22 percent low
beginning of 1941.

Consumers' stocks.—In the Bureau of Mi
tion of refined soft lead in 1941 (discussed
heading Domestic Consumption), consume
stocks of the three commercial grades of re
ning and end of 1941. The results obtaine
inventory picture of the consumer phase
totals shown in the following table indicate
amounting to 33 percent. Consumers'
during the year and more than offset the
producers' inventories of refined lead, in
consumption of lead was less than produce

Consumers' stocks of refined soft lead at beginning short tons [1]

	Corrod-ing
Dec. 31, 1940	24,880
Dec. 31, 1941	36,351

[1] Based upon survey of approximately 475 companies.

DOMESTIC CONSUM

New supply.—A complete picture of the
primary lead available for consumption in
owing to the confidential nature of forei
September 1941. In the following table t
is shown for the 4 years, 1937–40, but no
total the incomplete 1941 statistics. In
the total supply and exports that largely
listed only for January to September, inc
consider variation in producers' stocks,
considerably during the past 5 years the q
the true trend in actual consumption of ne

Refined primary pig lead available for consumption in the United States, 1937–41, in short tons

	1937	1938	1939	1940	1941
Supply:					
Imports	2,238	1,905	5,388	149,889	[1] 179,086
Production	467,317	383,669	484,035	533,179	570,967
	469,555	385,574	489,423	683,068	(2)
Withdrawn: Exports	20,091	[3] 45,866	74,392	[4] 49,079	[1] 13,494
Supply available for consumption	449,464	339,708	415,031	633,989	(2)

[1] Figures cover January to September, inclusive.
[2] Figures not available for publication.
[3] Includes small quantity of "sheets and pipes"; figures not separable.
[4] Includes 25,324 tons of foreign refined lead re-exported, according to American Bureau of Metal Statistics; official figures not available.

Consumption.—Consumption of lead in the United States during 1941 broke all records. The metal not only served as a war material in military applications and other defense uses but was called upon to help relieve the shortage of other metals, including aluminum, copper, zinc, and tin. Owing to the return of large quantities of secondary lead in discarded and obsolete articles and from the lead-consuming industries, the total consumption of pig lead greatly exceeds the supply of new lead available. The following table gives the American Bureau of Metal Statistics estimate of the total consumption of lead by industries, 1937–41.

Lead consumed in the United States, 1937–41, in short tons [1]

Purpose	1937	1938	1939	1940	1941
White lead	86,000	71,000	75,000	65,500	85,000
Red lead and litharge	57,000	43,000	57,200	59,400	89,100
Storage batteries	192,000	167,000	198,000	220,200	245,000
Cable covering	90,000	60,000	74,400	107,400	173,000
Building	45,000	36,000	50,000	65,000	95,000
Automobiles	12,000	6,000	8,900	11,000	12,000
Ammunition	39,500	31,200	42,300	56,000	71,500
Terneplate	6,400	4,300	6,000	6,000	8,700
Foil	21,700	22,000	21,800	23,500	45,000
Bearing metal	15,000	9,000	12,800	14,000	23,000
Solder	22,000	15,000	20,000	24,000	36,000
Type metal	17,000	12,000	14,000	16,800	20,000
Calking	15,000	12,000	16,000	19,200	31,000
Castings	6,000	6,000	7,500	9,000	14,000
Other uses	54,100	51,500	63,100	85,000	99,700
	678,700	546,000	667,000	782,000	1,950,000

[1] American Bureau of Metal Statistics. These estimates are for total consumption of lead, irrespective of whether its origin is primary or secondary. Antimonial lead is included.

The quantity of lead consumed by industry in 1941, as estimated by the American Bureau of Metal Statistics, was 34 percent above that in 1940 and 8 percent greater than the previous high level established in 1929. The principal use of lead is in the manufacture of storage batteries, and in recent years requirements of lead for this purpose have averaged approximately 30 percent of the total. Although the lead thus used in 1941 reached a new record high, the amount was only 23 percent of the total lead consumed, as all uses increased over 1940. This high figure reflects the efforts of the automobile industry to produce a record number of vehicles before conversion of plant facilities to war production plus expanded production

of batteries for strictly military and naval use.
ditions, lead withdrawn for use in storage batterie
the need for newly mined metal, as it rapidly retu
the form of scrap and there competes with the pri
use of lead for cable covering ranked again secon
percent. Although the white-lead industry drop
following increased consumption of lead for buildi
and litharge, the amount of lead used was 30 pe
1940.

The increases in use of white lead, and also red le
50 percent), were due principally to the shortage
derived from aluminum, zinc, and titanium. C
former record year 1929, lead consumption for t
1941 was as follows: Use in storage batteries was
cent, red lead and litharge 197 percent, and amm
cable covering was 79 percent of the 1929 figure,
cent, and building 99 percent. Of all the uses lis
in 1941 than in 1929 as compared with four in 19

In January 1942 the Bureau of Mines started
of the use of refined soft lead during 1941. The re
of approximately 475 companies are shown in t
Judging from available data as regards supply, s
ducers' stocks, the receipts of 838,835 tons of r
those consumers canvassed indicate that the cov
tially complete. However, the total does not re
consumption, as antimonial lead, unrefined scrap
alloys are not included. As this survey is the fir
the actual picture of the consumer side of the ind
tive analysis can be made with 1940 or earlier yea

Consumption of refined soft lead in the United States in 194 in short tons [1]

By grades:		By uses—Continued.	
Domestic:		Collapsible tubes	
Corroding	289,970	Foil	
Chemical	150,237	Pipes, traps, and t	
Common	257,114	Sheet lead	
Foreign: All grades	115,649	Solder	
		Storage batteries	
Total consumed	812,970	Terneplate	
		Type metals	
By uses:		White lead	
Ammunition	33,011	Red lead and litha	
Bearing metals	10,318	Chemicals and ina	
Cable covering	137,659	Other uses [2]	
Calking lead	35,876		
Casting metals	9,263	Total consumed	

[1] Based upon survey of approximately 475 companies; subject to revision.
[2] Includes consumption of lead in manufacture of tetraethyl lead used in ta

PRICES

The two major markets for lead in the United St
and St. Louis; much of the lead produced in this
prices based upon quotations in these markets.
quotations are influenced to some extent by the lo
normal times, usually prevail on the London mark
price seldom exceeds the St. Louis price by as m
difference (usually 0.35 cent a pound).

In 1941 the average prices for lead did not fluctuate, as in 1940, but followed the trend of the other common nonferrous metals and rose during the first quarter to a point of stabilization that was maintained for the rest of the year. The price for pig lead at New York, outside market, at the beginning of 1941 was 5.50 cents a pound. During subsequent weeks of heavy purchases the price advanced to 5.65 cents on February 10. Consumption continued to increase—at least in part attributable to additions to consumer inventory—and the quotation again jumped, rising to 5.75 cents on March 3. The increased use of lead as a substitute material for scarcer commodities added to the ever-growing demand, and the price advanced once more. This last step-up raised the quotation to 5.85 cents on March 26. What appeared to be forward buying on the part of consumers resulted in a continuation of demand above actual requirements. On April 5 the Office of Price Administration declared the possibility of a price ceiling and requested leading producers to refrain from further increases in price. This unofficial request was followed, and the price remained at 5.85 cents for the remainder of 1941. The average price for 1941 was 5.79 cents compared with 5.18 cents in 1940 and 5.05 cents in 1939.

Information regarding London Metal Exchange dealings, which were suspended at the outbreak of the war, continued to be unavailable during 1941.

In September 1939 the British Ministry of Supply announced the establishment of the maximum price of Empire lead at £17 per long ton ex ship and of foreign lead at £16 12s. 6d. ex ship. In December 1939 the Nonferrous Metal Control for the United Kingdom raised the price of Empire and foreign lead to £25 per long ton, duty paid, delivered. There was no reported change from this figure during 1941.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1939–41, in cents per pound [1]

Month	1939			1940			1941		
	St. Louis	New York	London	St. Louis	New York	London	St. Louis	New York	London
January	4.68	4.83	3.03	5.32	5.47		5.35	5.50	
February	4.65	4.80	3.20	4.93	5.08		5.45	5.60	
March	4.67	4.82	3.07	5.04	5.19		5.61	5.77	
April	4.63	4.78	3.00	4.92	5.07		5.70	5.85	
May	4.60	4.75	3.03	4.87	5.02		5.70	5.85	
June	4.65	4.80	3.04	4.85	5.00	(2)	5.70	5.85	(2)
July	4.70	4.85	3.08	4.85	5.00		5.70	5.85	
August	4.89	5.04	3.30	4.70	4.85		5.70	5.85	
September	5.30	5.45	(2)	4.78	4.93		5.70	5.85	
October	5.35	5.50	(2)	5.16	5.31		5.70	5.85	
November	5.35	5.50	(2)	5.58	5.73		5.70	5.85	
December	5.35	5.50	(2)	5.35	5.50		5.70	5.85	
Average	4.90	5.05	[3] 3.09	5.03	5.18	(2)	5.64	5.79	(2)

[1] St. Louis: Metal Statistics, 1942, p. 473. Average daily quotations of soft Missouri lead, f. o. b. St. Louis (open market), as reported daily in American Metal Market.
New York: American Metal Market, daily issues. Pig lead, New York (outside market), prompt shipment from West.
London: Metal Statistics, 1942, p. 478. 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 Federal Reserve Board.
[2] London Metal Exchange dealings suspended for duration of war. Official maximum price fixed by British Ministry of Supply at £25 in December 1939.
[3] London quotation in pounds sterling per long ton for first 8 months of 1939 was £14.7083.
[4] Average for 8 months; comparable average for New York was 4.83 cents.

FOREIGN TRA

As foreign trade statistics for 1941 can
period from January to September, no d
with 1940 totals. The figures do show th
the period more than maintained the hi
Imports.—Lead imported in the 9-m
short tons. Of this amount, pigs, bars,
lead in ore and matte 22 percent, and le
the comparative ratio for 1940 was 54, 3
Imports of pigs, bars, and old during 19
9-month total was substantially above th
for years the principal source of imports
38 percent of the total tonnage during
Canada with 21 percent. In 1940 the
respectively, which indicates a remarkab
try that was almost entirely in the form
same category included notable tonnag
Mexico remained the principal source.

Total lead imported into the United States, 1937–
short tons [1]

Year	Le ore m
1937	
1938	
1939	
1940	1
1941 (Jan.–Sept.)	

[1] Data include lead imported for immediate consumption p

Total lead imported into the United States, in ore,
by countries, in shor

Year	Canada	Mexico	New-found-land
1937	5,749	17,068	
1938	3,174	38,467	
1939	5,641	52,059	
1940	9,721	149,493	27,56
1941 (Jan.–Sept.)	54,309	99,226	15,96

[1] Data include lead imported for immediate consumption p
[2] Includes imports from Argentina as follows—1937: 17 tons;
and 1941 (Jan.–Sept.): 10,209 tons.

[1] Figures on imports and exports compiled by M. B. Price,
Department of Commerce.

Total lead imported into the United States in ore, matte, base bullion, pigs, bars, and old, 1937–41, by countries, in short tons [1]

Country	1937	1938	1939	1940	1941 (Jan.–Sept.)
In ore and matte:					
Africa			7	7,586	204
Argentina	17	4	3,362	16,469	10,209
Australia	2,211	6,434	7,612	17,472	14,618
Canada	5,211	3,173	5,624	8,666	3,879
Chile	474	2,107	1,844	6,271	1,300
Mexico	15,970	24,023	3,846	1,804	4,537
Newfoundland				27,563	15,963
Peru	10,132	9,317	7,174	18,383	3,415
United Kingdom	11	2	1,058	3,498	175
Other countries	47	310	315	3,588	3,784
	34,103	45,370	30,842	111,300	58,082
In base bullion:					
Mexico	1,067	14,444	47,915	19,009	23,494
Peru	239	198	84	179	52
Other countries	494	654	903	436	85
	1,800	15,296	48,902	19,624	23,631
In pigs, bars, and old:					
Australia	1,769	1,475	2,727	4,266	26,277
Canada	538	1	17	55	50,356
Mexico	31		298	128,680	71,195
Peru	2,344	1,736	4,051	18,452	31,324
Other countries	221	23	46	115	27
	4,903	3,235	7,139	151,568	179,179
	40,806	63,901	86,883	282,492	260,892

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

Lead remaining in warehouse in the United States, December 31, 1937–40, and September 30, 1941, in short tons

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

Year	Lead in ore and matte	Lead in base bullion [1]	Year	Lead in ore and matte	Lead in base bullion [1]
1937	57,509	2,622	1940	110,580	101,296
1938	76,287	11,524	1941 (Sept. 30)	105,944	47,343
1939	72,737	6,478			

[1] Figures also include pigs, bars, sheets, and old lead.

Lead [1] imported for consumption in the United States, 1937–41, by forms in which imported

Year	Lead in ores, flue dust, and mattes, n. s. p. f.		Lead in base bullion		Pigs and bars		Sheets, pipe, and shot		Not otherwise specified (value)	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1937	5,313	$507,945	188	$12,788	2,355	$174,077	376	$54,649	$13,527	$793,796
1938	6,722	543,164	304	31,147	2,001	84,109	166	30,905	11,611	1,449,541
1939	12,317	1,063,512	1,764	166,298	4,772	176,437	170	28,296	12,046	7,910,873
1940	76,027	4,659,445	9,992	929,046	36,882	2,269,075	231	36,444	18,480	21,382,284
1941 [2]	61,409	3,989,125	14,817	1,466,781	224,871	15,874,826	38	12,025		

[1] In addition to quantities shown (values included in total values), "Reclaimed, scrap, etc." imported as follows—1937: 349 tons, valued at $30,810; 1938: 189 tons, $20,374; 1939: 36 tons, $3,387; 1940: 24 tons, $3,917; and 1941 (Jan.–Sept.): 9 tons, $1,047.
[2] January to September, inclusive.

Miscellaneous products, containing lead, imported for States, 1937–41

Year	Babbitt metal, solder, white metal, and other combinations containing lead			
	Gross weight (short tons)	Lead content (short tons)	Value	
1937	618	178	$213,734	
1938	300	77	126,660	
1939	130	45	96,492	
1940	1,368	420	1,026,432	
1941 (Jan.–Sept.)	523	217	562,857	

Exports.—In the 9-month period of 1941 exp than the total for 1940, which indicates that t high level of 1939 is continuing. Exports by are given only for the first quarter of 1941; distribution.

Lead exported from the United States,

Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)	Year	Sho
	Short tons	Value			
1937	20,091	$1,838,262	8,679	1940	
1938	[1] 45,866	[1] 3,354,616	9,061	1941 [2]	
1939	74,392	4,547,219	10,379		

[1] Includes sheets and pipes; figures not separable.
[2] January to September, inclusive.

Pig lead exported from the United States, 1937–41, by

Destination	1937	1938 [1]	
Countries:			
Belgium	43	28	
Brazil	662	111	
Canada	7	101	
Denmark			
Finland		560	
France			
Germany	668	[2] 1,092	
Hungary			
Japan	7,320	30,203	
Kwangtung	50	314	
Mexico	8,122	11,403	
Netherlands			
Norway	112		
Philippine Islands	569	1,037	
Sweden		23	
United Kingdom	2,220	78	
Other countries	416	916	
	20,091	45,866	
Continents:			
North America	8,337	12,002	
South America	784	303	
Europe	2,949	1,950	
Asia	7,989	31,606	
Africa and Oceania	32	5	

[1] Includes sheets and pipes; figures not separable.
[2] In addition, 25,324 tons of foreign lead were re-exported, according to ...ics; official figures not available.
[3] Less than 1 ton.

WORLD ASPECTS OF LEAD INDUSTRY

A statistical picture of the lead situation throughout the world in 1941 is more difficult to draw than in 1940, owing to an even greater scarcity of production data.

Although official data are lacking, it is doubtful if world production and consumption gained much in 1941; indeed, the reverse may have been true.

Some of the details by countries, insofar as data are available under existing conditions of wartime restrictions, are discussed in the following pages.

REVIEW BY COUNTRIES

Argentina.—The Compania Minera Aguilar S. A., subsidiary of the St. Joseph Lead Co., supplied nearly 98 percent of the Argentine output of lead in 1941. During the year, Argentina produced 32,317 metric tons of 74-percent lead concentrates; in 1940 the output of concentrates amounted to 40,097 tons. From January to September (inclusive) 1941, 4,615 metric tons of lead ore were imported, almost entirely from Bolivia, compared with 2,888 tons for the same period in 1940. Nearly all the primary lead produced in Argentina comes from the National Lead Co. smelter at Puerto Vilelas; although the 1941 total is not known, production probably exceeded the 1940 figure of 12,864 metric tons, which included 2,476 tons from foreign ore.

Australia.—Although figures relating to production in Australia are not available for 1941, increased nonferrous metal-mining activity would appear to indicate an advance in lead output. Mt. Isa Mines, Ltd., continued to produce lead bullion steadily throughout 1941. The average mill extraction for the year ended June 30 was 79.7 percent lead recovered. During the year mining and milling continued at the property of the Lake George Mining Corporation, New South Wales, but toward the end of 1941 the lessened labor supply resulted in reduced output in the mine. With increased scarcity of shipping plus other factors, lead concentrates equal to nearly 8 months production had accumulated by the end of the year.

In Tasmania the North Farrell mine at Tullah is now the only producer of silver-lead ore. Output from the mine is reported to be 80 to 100 tons of concentrates a month.

Bolivia.—Mine production of lead in Bolivia, derived principally from small mines in the La Quiaca region, amounted to 15,654 metric tons contained in 26,356 tons of ore and concentrates. Production of lead in 1940 was 11,662 tons (content in ore). All concentrates are exported, during past years almost entirely to Argentina. The Bolivian Government has given the United States the exclusive right to purchase lead output, but during 1941 exports were divided between the United States and Argentina. It is reported that the Bolivian Banco Minero allotted 504,000 bolivianos for the erection of a lead smelter.

Brazil.—Production of lead remains comparatively undeveloped in Brazil. The Furnas lead-silver mine in the Iporanga district, State of São Paulo, is the principal producer and has considerable reserves of ore. The new selective-flotation plant of 35-ton daily capacity at Palmital treats ore averaging about 7 percent lead, 1[illegible] percent zinc, and 7 ounces of silver per ton and produces a 55.6

percent lead concentrate containing 50 [illegible] Recovery is approximately 79 percent. Op[illegible] this plant is a new lead-silver smelter con[illegible] first to be built in Brazil. Potential daily [illegible] plant operations, is 10 metric tons of refine[illegible] silver; the lead produced will be placed on [illegible] the silver will go to the mint. Power for [illegible] from a hydroelectric plant at Salto do C[illegible] River near Apiai. Although a larger ou[illegible] expected, the mines do not produce enou[illegible] smelter operating at full capacity.

Canada.—Although data on production o[illegible] to be unavailable, it is understood that the[illegible] more than maintained the high productio[illegible] The Sullivan mine of the Consolidated M[illegible] British Columbia, reputedly produced 90 pe[illegible] lead output. Large quantities have been sh[illegible] through contract with the Metals Reserve [illegible] reportedly near exhaustion. Mining has b[illegible] smaller properties, including that of the I[illegible] Ltd., northwest of Sudbury and at the old[illegible] near Ottawa.

Arrangements have reportedly been ma[illegible] Mines, Ltd., to construct a zinc-lead smel[illegible] West Kootenay district of British Columbia[illegible] 1942.

Mexico.—Mine production of lead in Mex[illegible] to 155,259 metric tons, a considerable decre[illegible] produced in 1940. Exports of lead in all[illegible] September (inclusive) 1941 totaled 114,60[illegible] with 138,739 tons for the same period in 19[illegible] tons (nearly 79 percent) were exported to th[illegible] with 79 percent for the entire year 1940.

Mexico continued to have labor problems[illegible] Smelting & Refining Co. closed its Monterr[illegible] Nuevo León, owing to a strike on April 2[illegible] until June 16. The capacity of the refiner[illegible] There was also a strike at the Monterrey [illegible] Metal Co., Ltd., from September 8 to Octob[illegible] Mexican output, and full production was n[illegible] after its settlement.

Peru.—Mine production of lead in Peru [illegible] metric tons compared with 50,439 tons in 1[illegible] during 1941 included an estimated 8,000 ton[illegible] of concentrates, and 38,000 tons of pig lea[illegible] 19,086, and 23,241 tons, respectively, in [illegible] shipped, the Cerro de Pasco Copper Corpo[illegible] percent. The corporation is installing a t[illegible] Oroya smelter—the only one in Peru—to ke[illegible] at capacity. Output of refined lead will be [illegible] tons annually. Construction of the new [illegible] concentrator is progressing, but the plant i[illegible] pletion before late 1942 or in 1943.

Spain.—Little information has been available regarding the Spanish lead industry during and following the years of the Spanish Civil War, which was concluded in 1939. It is reported that mine production of lead in 1940 amounted to about 57,900 metric tons and that 42,400 tons of metal were produced. For 10 months of 1941, mine and metal production has been given as approximately 35,600 and 24,400 tons, respectively.

Sweden.—In an effort to alleviate the acute lead shortage, the Swedish Boliden Mining Co. is preparing to mine and concentrate lead ore. The concentrates will be shipped to the Rönnskär smelter at Skelleftead for treatment. The company has extensive holdings at Laisvall in northern Sweden.

ZINC[1]

By A. L. Ransc

SUMMARY OUT

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GENERAL SUMM

The zinc industry in 1941 again was ch relationship with the national defense p eration between Government and the zi of smooth-running but intense activity endeavor to meet increased demands f industry increased its output 22 percent record and at the same time managed to stocks above the low point reached at mented supply was inadequate, and co decrease. Continued heavy demand fo a 29-percent gain in output above the 1940. In comparison, the lower grades At the close of 1941, smelters were operat was 96 percent of the total available, wi construction and planned in excess of ne

Although domestic mine output incr only 3 percent below the 1926 record, i consumption, and smelters continued greater amounts than in 1940. Imports exceeded the previous record for 1940 establish an all-time record for domestic ores, as well as a marked increase in ore

[1] This report deals primarily with the smelting branch of th given in the various State reports. Some zinc ore is used di See chapter on Lead and Zinc Pigments and Zinc Salts.)

containing 17,000 tons of zinc. This output is principally from the properties of the Cerro de Pasco Copper Corporation. Construction of the new 800-ton-per-day lead-zinc concentrator is progressing, but the plant is not scheduled for completion before late 1942 or in 1943. The corporation's 5-ton pilot electrolytic zinc plant operated successfully in 1940 and 1941, and erection of a commercial-size refinery of 100 tons daily capacity is under consideration.

Spain.—Little information has been available regarding the Spanish zinc industry during and following the years of the Spanish Civil War, which was concluded in 1939. It is reported that mine production of zinc in 1940 amounted to about 74,000 metric tons and that 12,300 tons of metal were produced. For 10 months of 1941, mine and metal production has been given as 60,900 and 10,400 tons, respectively. The zinc deposits of Spain are mainly in the Santander region, the principal mines being operated by the Real Compañía Asturiana de Minas.

LEAD AND ZINC PIGMENT

By H. M. Meyer and A

SUMMARY OU

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GENERAL SUM

Expansion in the use of lead and zinc of this series for 1940, resulted in the high records for this group of comm ments were due to considerable gains lead for storage batteries and of dry and others for the manufacture of p in the use of zinc oxide for rubber ma edented quantities of litharge and z record amounts of litharge used in inse of black oxide or suboxide of lead, not also rose above all previous years.

The actual demand for many produ made from metals and metallic ores, of zinc and lead pigments unquestio larger had adequate quantities of raw manufacture been available. Moreov and titanium pigment totals in that been more favorable to titanium an for these pigments were more restricte

Zinc is closely related to war need quently, a tight situation in zinc metal of pigments arose early in the war. T more than other pigments, for more m than in any other zinc pigment. In making zinc oxide had risen so that r oxide and lithopone (in terms of zinc materials. More than half of the zinc is made direct from ore. Although percent during 1941, the zinc content scrap actually decreased more than meanwhile, increased 29,000 tons in t

as June 10, 1941, zinc was placed under full priority control by the Office of Production Management (now the War Production Board). Producers of zinc oxide were ordered to set aside in July an amount equivalent to 10 percent of their May output for emergency allocation by the Director of Priorities. From then until the end of the year the amount to be set aside ranged from 10 percent for some months to none for others; the percentage usually applied to the second preceding month.

Pig lead supplies appeared to be satisfactory at the beginning of 1941; however, the greatly expanded use of this metal for war and civilian purposes, partly as a substitute for scarcer materials, brought noteworthy changes in this favorable position as the year progressed. Consequently, lead was placed under full priority control in October.

In 1941 lead pigments, as a group, made a better showing than zinc pigments in relation to 1940, as the total quantities sold advanced 37 and 27 percent, respectively. In relation of 1941 to averages for 1925–29, however, zinc pigments performed better, having risen 10 percent compared with 1 percent for lead pigments. Failure of white lead in oil to maintain its relative position caused the poorer showing of lead pigments in the latter comparison.

The titanium pigments group, competitors in the white pigment field, experienced unprecedented activity again in 1941.

Average quoted prices for lead and zinc pigments were generally higher in 1941 than in 1940, and the average values reported to have been received by producers confirmed the trend of quotations.

Salient statistics of the lead and zinc pigments industry of the United States, 1925–29 (average) and 1937–41

	1925–29 (average)	1937	1938	1939	1940	1941
Production (sales) of principal pigments:						
White lead (dry and in oil) short tons	154,483	98,213	100,213	98,429	80,562	113,000
Litharge.....do....	84,845	83,902	68,711	89,518	89,841	122,280
Red lead.....do....	41,362	33,931	30,183	30,076	42,200	53,838
Zinc oxide.....do....	154,208	114,652	79,129	114,552	113,213	148,833
Leaded zinc oxide...do....	26,609	40,343	38,216	42,684	45,362	68,920
Lithopone.....do....	177,745	154,771	125,746	142,759	151,802	176,643
Value of products:						
All lead pigments.....	$60,092,000	$35,676,000	$28,351,000	$35,485,000	$32,628,000	$46,572,000
All zinc pigments.....	41,314,000	28,038,000	23,301,000	28,794,000	28,747,000	39,210,000
Total.....	101,406,000	63,714,000	51,652,000	64,279,000	61,375,000	85,782,000
Value per ton received by producers:						
White lead (dry).....	178	140	123	138	137	147
Litharge.....	176	143	122	123	126	134
Red lead.....	193	160	137	140	141	161
Zinc oxide.....	133	103	117	117	118	128
Leaded zinc oxide.....	124	104	107	114	114	118
Lithopone.....	98	78	79	73	67	71
Foreign trade:						
Lead pigments:						
Value of exports.....	1,346,000	586,000	510,000	715,000	594,000	[1] 833,000
Value of imports.....	30,000	17,000	10,000	10,000	14,000	[1] 9,000
Zinc pigments:						
Value of exports.....	2,150,000	610,000	339,000	925,000	1,585,000	[1] 2,313,000
Value of imports.....	931,000	414,000	285,000	280,000	46,000	[1] 15,000
Export balance.....	2,535,000	765,000	554,000	1,350,000	2,119,000	[1] 3,122,000

[1] Figures cover January to September, inclusive.

PRODUCTIO

Sales have more significance in this re
to lack of data on stocks at the beginni
some instances materials reported as on
have been sold later under another cla
figures afford a more accurate guide to
into consumption. To prevent duplicati
handling sales figures. Some pigments
products at one plant actually are used
mediate product in the manufacture of
the lead and zinc pigments canvass. Ba
the manufacture of leaded zinc oxide is
connection, but it is not the only one.
ployed in this report only in calculatin
ments and salts in the section on Raw M
of Lead and Zinc Pigments and Zinc Sa
ducers in manufacturing products at th
as sales.

The total value of sales of lead and
percent rise, from $61,375,000 in 1940 to
noteworthy increase was due to advances
to gains in average values received by pro

Lead pigments.—The lead pigments
previous years in sales were litharge, red
these commodities gained 36, 25, and 2
previous high records established in 194
whole, price quotations in 1941 did not e
1940 range; but, in general, they were ab
average quoted prices topped those of th
of the lead pigments made gains in avera
ers. Consequently, although lead pigmer
percent) in total quantity the increase (43
was even greater.

White lead in oil advanced 16 percen
all other pigments. Gains in sales of w
pigment up to 94-percent of the quanti
highest proportion it has ever attained in

Lead pigments sold by domestic manufacturers

Pigment	1940	
	Short tons	Value (at p... exclusive of co...)
		Total
Basic lead sulfate or sublimed lead:		
White.....	5,493	$692,769
Blue.....	707	92,076
Red lead.....	42,200	5,970,156
Orange mineral.....	137	30,441
Litharge.....	89,841	11,305,954
White lead:		
Dry.....	30,115	4,114,785
In oil[1].....	50,447	10,421,585

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

Lead pigments sold by domestic manufacturers in the United States, 1910–41, in short tons

Year	White lead		Basic lead sulfate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1910	32,237	111,673	9,858		[1] 10,801	[1] 676	23,742
1911	25,834	106,778	10,019		[1] 10,540	[1] 766	25,190
1912	26,242	120,591	11,085		[1] 21,120	[1] 545	29,111
1913	24,196	118,430	12,452		[1] 17,635	[1] 434	23,093
1914	29,076	130,398	12,665		[1] 18,607	[1] 426	27,345
1915	33,007	122,194	13,304		[2] 19,435	(3)	26,118
1916	32,938	96,041	10,977	1,287	[2] 23,035	(3)	37,739
1917	27,869	87,331	8,231	1,369	[2] 25,478	(3)	44,102
1918	20,089	82,709	7,403	1,343	[2] 30,069	(3)	48,874
1919	30,085	100,005	9,068	1,350	[2] 32,362	(3)	46,739
1920	33,678	112,017	12,412	928	[2] 34,431	(3)	62,329
1921	26,738	143,545	11,568	463	21,805	381	41,909
1922	41,598	153,393	13,765	972	30,509	370	58,261
1923	37,786	125,087	11,949	800	38,037	646	76,107
1924	42,622	144,872	14,572	1,088	36,813	331	74,724
1925	43,426	120,479	14,996	1,090	41,669	840	86,546
1926	37,968	111,845	12,271	1,236	42,550	813	82,540
1927	38,669	119,020	13,482	1,061	39,073	709	81,655
1928	42,049	111,923	16,002	1,234	40,497	459	85,870
1929	42,150	104,872	15,580	1,234	43,021	678	87,916
1930	32,548	69,592	10,308	1,219	32,941	356	72,578
1931	30,922	66,446	8,790	896	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	22,569	56,165	6,399	668	26,743	234	68,733
1935	27,972	68,859	7,572	727	29,776	252	79,930
1936	34,775	83,632	7,531	891	34,896	248	86,246
1937	32,661	65,552	7,514	1,108	33,931	206	83,902
1938	29,813	70,400	5,030	771	30,183	127	68,711
1939	30,509	67,920	4,688	850	39,976	131	89,518
1940	30,115	50,447	5,493	707	42,200	137	89,841
1941	54,689	58,311	8,739	1,631	53,838	246	122,280

[1] Small quantity of orange mineral included with red lead.
[2] Orange mineral included with red lead.

Zinc pigments and salts.—Sales of leaded zinc oxide established another new high record in 1941, and those of the lead-free class were the largest since 1929; the total of both grades had never been exceeded before. Lithopone sales, although not attaining a new peak, had been higher only from 1927 to 1929, inclusive. The sharp rise in the use of ore in the manufacture of zinc oxide was due primarily to the difficulty in obtaining adequate supplies of zinc metal and scrap in 1941. The average quoted price for lithopone in 1941 was above the range for 1940, but, in general, prices for various grades of zinc oxide were at or close to the top of the ranges for 1940. Producers reported receiving higher average values for all pigments during 1941.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1940–41

Pigment or salt	1940			1941		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [1]	113,213	$13,361,980	$118	148,833	$18,558,474	$12
Leaded zinc oxide [1]	45,362	5,187,522	114	68,920	8,101,782	11
Lithopone	151,802	10,197,897	67	176,642	12,550,193	7
Zinc chloride, 50° B	(2)	(2)	(2)	(2)	(2)	(2)
Zinc sulfate	11,937	695,496	58	19,201	1,424,456	7

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

Zinc pigments and salts sold by domestic manuf
in short ton

Year	Zinc oxide	zi
1910	58,481	
1911	63,827	
1912	84,002	
1913	75,700	
1914	82,809	
1915	109,261	
1916	100,339	
1917	107,886	
1918	100,286	
1919	117,639	
1920	99,444	
1921	74,329	
1922	128,405	
1923	126,987	
1924	131,470	
1925	151,354	
1926	146,923	
1927	151,246	
1928	160,904	
1929	160,611	
1930	119,142	
1931	95,700	
1932	72,250	
1933	98,542	
1934	87,088	
1935	99,697	
1936	126,800	
1937	114,652	
1938	79,129	
1939	114,552	
1940	113,213	
1941	148,833	

[1] No canvass.
[2] Figures represent production.
[3] Data not available.

Complete data covering the produc
years are not available owing to the
from one producer, whose output is be
Sales of zinc sulfate established a sec
61 percent above the previous record, a

CONSUMPTION BY

White lead.—Total sales of white lea
and the dry variety established a new
oil did not make a good showing in rela
for the pigments industry.
Normally about 95 percent of the
manufacture of paint. For the past 2
closer to 90 percent, although some o
"Other" may rightfully belong under
Early in 1942, the Federal Specifica
Emergency Alternate Specifications, i
regular specifications, namely: TT–P–
Titanium-Zinc and Titanium-Zinc-Lead
White Lead. A single emergency pain
will be designated E–TT–P–101a, Titan
Lead, Outside, Ready-Mixed White
implies two types, only the titanium-z
covers light tints as well as the whit
requirements are: P gment, minimum

titanium dioxide, minimum 10 percent; zinc oxide, minimum 24 percent; white lead, minimum 24 percent; sum of zinc oxide and white lead, minimum 48 percent; inert pigments, maximum 40 percent. A semi-chalk-resisting type of titanium dioxide is required.

Distribution of white lead (dry and in oil) sales, 1937–41, by industries, in short tons

Industry	1937	1938	1939	1940	1941
Paint	93,580	95,018	92,380	73,137	100,668
Ceramics	2,506	1,918	1,767	3,029	3,704
Other	2,127	3,277	4,282	4,396	8,631
	98,213	100,213	98,429	80,562	113,000

Basic lead sulfate.—The outstanding use of basic lead sulfate is also in the manufacture of paint; 90 percent of the total was sold for that purpose in 1941. The increasing use of this pigment in making leaded zinc oxide has been noted in earlier chapters of this series. The practice assumed record-breaking proportions in 1941, when 12,000 tons were so used compared with the previous peak of 7,700 tons in 1939. These quantities are included in the totals for leaded zinc oxide but not in those for basic lead sulfate.

Distribution of basic lead sulfate sales, 1937–41, by industries, in short tons

Industry	1937	1938	1939	1940	1941
Paints	8,255	5,024	5,170	5,593	9,285
Rubber	213	91	140	129	200
Storage batteries	6	3	4	4	8
Other	148	683	224	475	877
	8,622	5,801	5,538	6,200	10,370

Red lead.—Sales of red lead were record-breaking in 1941; they exceeded the previous peak in 1929 by 25 percent and fulfilled the promise of increased use made when it became evident that a tremendous expansion in plant construction to supply materials for war purposes would develop. Although sales to makers of storage batteries continued to represent the larger part of the total, they did not advance in the same ratio as sales to manufacturers of paints, which gained 68 percent.

An Emergency Alternate Federal Specification for Red-Lead-Base Ready-Mixed Paint, E–TT–P–86, changed the specifications for this paint to: Pigment, red lead (95 percent grade), minimum 40 percent; red iron oxide (70 percent Fe_2O_3), minimum 20 percent; zinc oxide, minimum 10 percent; extenders, remainder (magnesium silicate, aluminum silicate, silica, or mixtures).

Distribution of red lead sales, 1937–41, by industries, in short tons

Industry	1937	1938	1939	1940	1941
Storage batteries	20,275	19,057	24,709	26,718	27,408
Paints	10,440	8,698	11,421	11,949	20,186
Ceramics	854	655	1,123	1,117	1,568
Other	2,362	1,773	2,723	2,416	4,710
	33,931	30,183	39,976	42,200	53,872

Orange mineral.—This pigment is produ
Ink manufacture took the principal amou

Distribution of orange mineral sales, 1937–4

Industry	1937	19
Ink manufacture	76	
Color pigments	51	
Other	79	
	206	

Litharge.—Sales of litharge made a new
largely to the sharp advance in its us
largest consuming industry) and to note
makers of ceramics, chrome pigments, and
industries took more litharge than ever
its use in rubber and varnish manufactu
1940, had been exceeded in earlier years.
lead used by storage-battery manufact
peaks in 1939, 1940, and 1941. The tot
compared with 53,000 in 1940 and 45,0
oxide are not included in Bureau of Min

Distribution of litharge sales, 1937–41, b

Industry	1937	19
Storage batteries	32,228	3
Insecticides	18,242	1
Ceramics	7,577	
Chrome pigments	7,330	
Oil refining	8,311	
Rubber	1,650	
Varnish	3,366	
Linoleum	264	
Other	4,925	
	83,902	6

Zinc oxide.—Although zinc oxide sa
those in 1940, unlike some of the pign
in 1941, they were exceeded by the totals
3 years 1927, 1928, and 1929. The de
manufacture of rubber and ceramics
were also registered in sales for paint ma
and textiles, but the quantities did not re
for these purposes. The inadequacy of z
in 1941 caused a sharp downturn in the
zinc oxide made in that year, and only
manufactured by that method; 76 pe
zinc oxide. These percentages represen
64 percent, respectively, for 1940 and
1939. It is impossible to say what zinc
if enough zinc had been available to mee
facture of this product.

Provisions for a zinc oxide monthly
Director of Prioritie , are discussed in

report. The maximum prices for various grades of zinc oxide, which the Office of Price Administration requested manufacturers to maintain beginning January 1, 1942, are discussed in the price section of this report.

A new plant for the manufacture of zinc oxide by direct flash fuming zinc concentrates was completed and put in operation by the Eagle-Picher Mining & Smelting Co. in January 1941 at Galena, Kans.; a second unit that doubled the capacity of the plant was constructed and went into production early in July. Production of zinc oxide was begun during the year by the Gulton Metals Refining Co. at Metuchen, N. J.

Distribution of zinc oxide sales, 1937–41, by industries, in short tons

Industry	1937	1938	1939	1940	1941
Rubber	67,061	46,266	70,187	70,979	90,429
Paints	27,987	20,884	25,334	23,268	30,304
Ceramics	5,216	4,908	6,572	6,352	8,598
Floor coverings and textiles	9,019	3,030	5,641	4,752	6,991
Other	5,369	4,041	6,818	7,862	12,513
	114,652	79,129	114,552	113,213	148,832

Leaded zinc oxide.—This increasingly popular pigment continued to advance in 1941, and sales reached new heights—68,920 tons, or 52 percent above the previous high record for 1940. One factor in the large increase during 1941 is that virtually all the zinc content of this pigment comes from zinc ores and concentrates; consequently, gains in its production placed no strain on tight supplies of zinc metal and scrap. As usual, paint manufacturers took nearly all the leaded zinc oxide sold. The total shown for leaded zinc oxide in 1941 includes 12,000 tons of basic lead sulfate used to increase the lead content of the product; this tonnage is excluded from the basic lead sulfate totals to avoid duplication in reporting data for metals.

Distribution of leaded zinc oxide sales, 1937–41, by industries, in short tons

Industry	1937	1938	1939	1940	1941
Paints	39,584	37,348	41,519	44,341	67,472
Rubber	97		1		1
Other	662	868	1,164	1,021	1,447
	40,343	38,216	42,684	45,362	68,920

Lithopone.—Lithopone statistics are reported upon the basis of the regular lithopone content of high-strength lithopone plus normal lithopone sold as such; before 1936, they were upon the basis of standard-strength plus high-strength product. Sales in 1941 were 16 percent above those in 1940 and with the exception of 1927–29 were the largest on record. Paints, varnish, and lacquers take the principal part of the total lithopone sold, and sales to such users increased 13 percent in 1941; this use took about 80 percent of the total in several years but only 77 percent in 1940 and 75 percent in 1941. Floor coverings and textiles have used 12 to 13 percent and rubber 2 to 3 percent of the total in recent years. Based upon somewhat

incomplete information, separation of the
the following table for floor coverings a
16,000 tons were used for linoleum and fe
the remainder for coated fabrics and text
artificial leather, and similar products). C
5,559 tons for paper and 2,301 tons for pr
additional quantity for printing ink cann
total figures for paints.

Plant capacity for the production of
total 181,600 tons at the end of 1941.

Distribution of lithopone sales, 1937–41, by

Industry	1937	1938
Paints, etc.	122,915	101,
Floor coverings and textiles	20,194	15,
Rubber	4,383	3,
Other	7,279	5,
	154,771	125,

The use of ordinary-strength lithopone
tanated lithopone (which usually contains
a peak in 1937, when 19,400 tons were so
were used for this purpose. The lithopo
table are included in the totals for ordinary
table.

*Titanated lithopone produced in the United States
its manufacture, 1937–41, in*

Year	Titanated lithopone produced	Ordinary lithopone used		
1937	23,000	19,400	1940	
1938	20,100	17,000	1941	
1939	16,100	13,700		

Zinc sulfide.—Although zinc sulfide has b
in the United States in recent years, one
dustry; therefore, the Bureau of Mines
release data on this commodity. Only t
in 1941.

Zinc chloride.—The Bureau of Mines c
production as one producer, whose output
failed to supply reliable data.

Zinc sulfate.—Sales of zinc sulfate in 194
the high record established in 1940, thus c
began in 1933 and was interrupted only i
was 61 percent. Of the 1941 total, 5,555 to
ical manufacture (including the medicina
3,038 for agricultural purposes, 1,422 for pa
1,203 for glue manufacture, 502 for electrog
reagents, and 130 for textile printing and c
1,935 tons was not report ed.

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

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and such miscellaneous secondary materials as scrap and waste from various industrial processes. In 1941, 91 percent of the lead pigments were derived from pig lead and 9 percent from ore. The proportion for zinc pigments in 1941 was 74 percent from ore, 8 percent from slab zinc, and 18 percent from secondary materials.

Metal content of lead and zinc pigments produced by domestic manufacturers, 1940–41, by sources, in short tons

Source	1940		1941	
	Lead in pigments [1]	Zinc in pigments	Lead in pigments [1]	Zinc in pigments
Ore:				
Domestic	16,869	94,491	23,051	129,820
Foreign			290	2,464
Metal	196,235	19,421	248,674	15,463
Secondary material [2]		29,675	400	31,703
	213,104	143,587	273,315	179,150

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

The following tables give the source of the metal used in the manufacture of each pigment and salt. Pig lead is employed exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and is used also in the manufacture of basic lead sulfate. The lead content of leaded zinc oxide made from basic zinc sulfate, which in turn was made from pig lead, is credited to pig lead in the table. Zinc oxide is the only pigment in which considerable slab zinc is used. Ore is employed in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulfate, and basic lead sulfate. A substantial proportion of the zinc in lithopone and zinc chloride made in the United States is derived from secondary material. A decided increase has been noted in the quantity of secondary zinc consumed in the manufacture of zinc oxide since 1933. The relative scarcity of zinc metal and scrap in 1941 caused declines in the use of both these materials for the manufacture of zinc oxide in the face of a noteworthy gain in production of the pigment.

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

Pigment	1940					
	Lead in pigments produced from—				Total lead in pigments	
	Ore		Pig lead	Secondary material		
	Domestic	Foreign				D
White lead			69,535		69,535	
Red lead			38,905		38,905	
Litharge			85,005		85,005	
Orange mineral			180		180	
Basic lead sulfate	4,705		1,436		6,141	
Leaded zinc oxide	12,164		1,174		13,338	1
	16,869		190,235		213,104	2

Zinc content of zinc pigments and salts produced by d by sources, in short to

Pigment or salt	1940					
	Zinc in pigments and salts produced from—				Total zinc in pigments and salts	
	Ore		Slab zinc	Secondary material		
	Domestic	Foreign				D
Zinc oxide	59,463		18,696	15,148	93,307	8
Leaded zinc oxide	21,178		680	662	22,520	2
Lithopone	13,850		45	13,865	27,760	1
Zinc sulfide	(1)				(1)	
Zinc chloride	(1)		(1)	(1)	(1)	
Zinc sulfate	1,426			1,958	3,384	

[1] Data not available.

PRICES

The total values reported by producers f
and zinc salts are given in the tables in th
The average reported values for all lead pi
in oil and basic lead sulfate (blue), were a
to $20 a ton; these two classes remained unc
age price quotations for all lead pigments
principally because they were near or at th
rather than because they actually exceede
Price changes for lead oxides, as usual,
changes for the metal. White lead prices
January 1941 and remained unchanged the
All values reported by producers for zin
higher in 1941 than in 1940. On the whol
also were higher than in 1940 because the
of the 1940 range. They were generally ur
although Pacific coast p ices for lithopo

sulfide rose ¼, ½, and ½ cent a pound, respectively, in midyear. Prices for lithopone and zinc sulfide were advanced on the first day of 1941 but did not change subsequently. Zinc sulfate prices rose ½ cent a pound in June.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1938–41, in cents per pound

Product	1938	1939	1940	1941
Basic lead sulfate, or sublimed lead, less than carlots, barrels	5.50– 6.50	6.25– 6.50	6.25– 6.75	6.50– 7.00
White lead, or basic lead carbonate, dry, carlots, barrels	6.00– 7.00	7.00	7.00– 7.50	7.50
Litharge, commercial, powdered, barrels	5.50– 7.50	6.25– 7.75	6.25– 8.25	7.00– 8.25
Red lead, dry, 95 percent or less, less than carlots, barrels	7.00– 8.50	7.75– 9.00	7.75– 9.25	8.50– 9.25
Orange mineral, American, small lots, barrels	9.50–11.00	10.25–11.25	10.25–11.75	11.00–11.75
Zinc oxide:				
American process, lead-free, bags, carlots	6.25– 7.50	6.25– 7.50	6.25– 7.50	6.50
American process, 5 to 35 percent lead, barrels, carlots	5.90– 6.38	6.25– 6.38	6.25– 6.75	6.25– 6.75
French process, red seal, bags, carlots	7.50	7.50	7.50– 7.75	7.75
French process, green seal, bags, carlots	8.00	8.00	8.00– 8.25	8.25
French process, white seal, barrels, carlots	8.75	8.75	8.75– 9.00	9.00
Lithopone, domestic, 5-ton lots, bags	4.38– 4.63	4.00– 4.38	3.85– 4.00	4.10
Zinc sulfide, less than carlots, bags, barrels	8.63– 9.50	7.75– 8.88	7.75– 8.00	8.00– 8.25
Zinc chloride, works:				
Solution, tanks	2.25	2.25	2.25	2.25– 2.50
Fused, drums	4.25– 5.75	4.25– 5.75	4.25– 5.75	4.25– 6.50
Zinc sulfate, crystals, barrels	2.65– 4.05	2.90– 3.65	2.90– 3.90	3.15– 4.40

The favorable behavior of prices for lead and zinc pigments and zinc salts, in the face of the tremendous pressure of record-breaking sales and scarcity of raw materials, was in deference to the known Government desire to avoid price advances wherever possible throughout the war emergency.

In December zinc oxide producers were requested by the Office of Price Administration to agree individually to a list of maximum prices for their product. The O. P. A.-approved ceiling prices per pound for various grades of zinc oxide delivered in bags in carlots were 7.25 cents for lead-free American process oxide, 6.75 cents for leaded zinc oxides containing 35 percent or more lead, 7.125 cents for leaded zinc oxides containing less than 35 percent lead, 9.50 cents for lead-free French process oxides other than U. S. P., and 10.50 cents for French process U. S. P. oxide. Price schedule 80 of the Office of Price Administration, effective February 2, 1942, set a maximum price of 4.25 cents per pound for the normal grade of lithopone.

FOREIGN TRADE [1]

Any discussion of foreign trade in 1941 is necessarily restricted because data for October and subsequent months are held confidential by the Department of Commerce. Incomplete figures for imports fail to indicate anything unusual in that phase of foreign trade. It is noteworthy, however, that export values for the first 9 months of 1941 exceeded those for the full year 1940 in each group covered by the following table. Lithopone continued to be the outstanding item in the export class, whereas zinc oxide led again in the relatively unimportant import class.

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

Value of foreign trade of the United States 1940–41

	Import
Lead pigments:	
White lead	$
Red lead	
Litharge	
Orange mineral	
Other lead pigments	13,
	13,
Zinc pigments:	
Zinc oxide	45,
Lithopone	
Zinc sulfide	
	46,
Lead and zinc salts:	
Lead arsenate	
Zinc chloride	1,
Zinc sulfate	7,
	8,
Grand total	68,

[1] Data not available.

Lead pigments and salts.—In 1941, a
modities were insignificant.

Lead pigments and salts imported for consum

Year	Sh		
	Basic carbonate white lead	Red lead	Li
1937	34	1	
1938	20	1	
1939	11	2	
1940	2		
1941 (Jan.–Sept.)	2	2	

[1] Less than 1 ton.
[2] Includes also—1937: Lead pigments, n. s. p. f., $8 (100 p
pounds), and suboxide of lead, n. s. p. f., $9,396 (55,453 pound
pounds), and suboxide of lead, n. s. p. f., $5,335 (31,834 poun
pounds), and suboxide of lead, n. s. p. f., $6,620 (40,445 poun
(71,148 pounds); 1941 (Jan.–Sept.): Suboxide of lead, n. s. p.

All export items covered by the fo
relative importance, as regards quanti
September 1941.

Lead pigments and salts exported from

Year		Re
	White lead	
1937	1,236	
1938	1,411	
1939	2,024	
1940	1,360	
1941 (Jan.–Sept.)		

Zinc pigments and salts.—No zinc pigment or salt was imported in significant amounts during 1941.

Zinc pigments and salts imported for consumption in the United States, 1937–41

Year	Short tons						Total value
	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	
	Dry	In oil					
1937	680	95	5,601	113	607	593	$488,116
1938	579	66	3,932	12	272	392	321,446
1939	1,496	66	2,641	7	399	325	317,719
1940	273	45	.....	(1)	19	245	54,922
1941 (Jan.–Sept.)	107	11	(1)	1	.....	78	19,162

[1] Less than 1 ton.

Shipments of zinc pigments from the United States, like those of the lead group, were larger during the first 9 months of 1941 than in all of 1940. Lithopone continued to be the feature of the export trade in lead and zinc pigments; it was the largest single item in both quantity and value and established a new high record. Exports of zinc oxide in the first 9 months of 1941 were larger than in any calendar year since 1930.

Details covering exports in 1941, by countries, can be shown for the first 3 months only, and these are not sufficiently complete to be recorded separately here. As indicated by tables in the preceding chapter of this series, Canada normally receives the preponderant share of exports of lithopone, 55 percent of the total for the period 1936–40 having gone to that country. South American countries have taken increasing quantities of lithopone in recent years: they took 22 percent of the total in 1940. The pattern of exports of zinc oxide differs from lithopone in that the quantities shipped do not go so largely to only a few destinations. Canada is the destination of the largest part of the zinc oxide exported, having received 37 percent of the total for 1936–40. A relatively large tonnage has gone to Asiatic countries in recent years, and increasing quantities have gone to Mexico and Brazil.

Zinc pigments and salts [1] exported from the United States, 1937–41

Year	Short tons		Total value	Year	Short tons		Total value
	Zinc oxide	Lithopone			Zinc oxide	Lithopone	
1937	2,953	2,671	$609,954	1940	3,239	14,298	$1,584,667
1938	1,163	1,734	339,415	1941 (Jan.–Sept.)	5,404	16,954	2,312,718
1939	3,485	4,845	925,468				

[1] Zinc salts not separately recorded.

GOLD, SILVER, COPPER, AN

(MINE REPORT

By CHAS. W. HENDERSON A

SUMMARY OUT

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SUMMARY

Gold recovered from Alaska ores and fine ounces valued at $24,341,345—a d 755,970 ounces valued at $26,458,950 in in 1941 was 99 percent of the total gr copper, and lead produced. The silver produced were byproducts of gold min ing lode mines decreased from 73 in 19 nected-bucket dredges from 49 to 47, ar tions from 1,020 to 752.

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

Yardage figures used in measuring m tions are "bank measure"; that is, the ground before treatment.

The value of metal production herein at the following prices.

Prices of gold, silver, copper, lea

Year	Gold [1]	Sil
	Per fine ounce	*Pe ou*
1937	$35.00	
1938	35.00	
1939	35.00	
1940	35.00	
1941	35.00	

[1] Price under authority of Gold Reserve Act of January 3 from January 18, 1837, to January 31, 1934, was $20.67+($20.6
[2] 1937: Yearly average weighted Treasury buying price for price for newly mined silver.
[3] Yearly average weighted price of all grades of primary m
[4] 0.64646464.
[5] 0.67978787.
[6] 0.71111111.

it. In its place, hospitals were supplied with radon, individual losses of which would not be significant. The radon tubes were filled in subterranean plants, one of which was financed with $25,000 cabled to London by the British War Relief Society in the United States.[25] Polonium is a radioactive element (atomic number, 84) recovered at the Port Hope refinery and used in minute traces in spark-plug electrodes to ionize the air gap and speed the passage of a hot spark under all temperature conditions, even when the battery is low. Made by the Firestone Tire & Rubber Co., the nickel electrodes either are coated with a film of polonium or contain 0.000000001 percent polonium as an alloy. The longer the radioactive spark plug is used, the more efficient it becomes.[26] Mesothorium is a radium isotope (atomic numbers, 88 and 89) which is used as a substitute for radium. It is obtained from monazite-sand residues and is more radioactive than radium itself. The principal application at present is probably in black-out paints. The number of mesothorium specimens tested annually by the National Bureau of Standards gives some index as to demand. Such specimens contained 1,026 milligrams in 1934, 300–600 yearly in 1935–38, 49 in 1939, and 301 in 1940 and reached a high of 1,451 in 1941.

Uses of uranium.—Uranium is now used principally in ceramics, luminescent paints, tool steels, and chemicals. Uranium oxides color pottery glazes and porcelain bodies black, gray, brown, or green in a reducing environment and yellow, orange, or red under oxidizing conditions. They are sometimes used as a crystallizing agent in crystalline glazes. Sodium uranate and sodium uranyl carbonate produce the fluorescence typical of uranium glasses, which are yellowish green in transmitted light and emerald green in reflected light. These compounds under other conditions color glass yellow, orange, or red.[27] Uranium salts are incorporated in luminescent paints, either for their own inherent fluorescence or as an activator for such accessory compounds as zinc-cadmium sulfide and beryllium oxide. Uranium imparts desirable properties to tool steels. The metal is introduced as ferrouranium or, more recently, as a master alloy containing 66 percent uranium and 33 percent nickel. Stainless silverware can be made by plating the ware in an electrolytic bath containing silver fluoride and compounds of uranium and tin. Uranium oxides are used as catalysts in a number of organic chemical reactions.

SELENIUM AND TELLURIUM

Production of selenium and of tellurium in the United States in 1941 increased 89 and 162 percent, respectively, and sales showed corresponding gains. Producers' stocks of both metals declined during the year. Selenium imports (all from Canada) expanded. Salient statistics for 1937–41 are shown in the accompanying table. Canada increased its production of selenium and tellurium during 1941, and the Germans are said to have brought into operation a new selenium plant in the Mansfeld copper district.[28] The base price of selenium (black, powdered, 99.5 percent) and of tellurium continued to be

[25] American Medical Association, Radon Production Plant given to England: Jour., vol. 116, No. 1, January 4, 1941, p. 58.
[26] American Chemical Society, News Edition: Vol. 19, No. 19, October 10, 1941, p. 1111.
[27] Ceramic Industry, vol. 38, No. 1, January 1942, pp. 107 and 112.
[28] Metal Bulletin (London), No. 2642, November 11, 1941, p. 4.

$1.75 a pound throughout 1941. Glass Industry
selenite at $1.40–$1.60 and sodium selenite at $1.50–

Salient statistics of selenium and tellurium in the United

Year	Selenium					
	Production (pounds)	Sales [1] (pounds)	Producers' stocks at end of year (pounds)	Imports [2]		Producti (pound
				Pounds	Value	
1937	435,821	282,598	306,200	92,523	$161,382	51,4
1938	226,674	166,494	365,300	101,034	163,598	11,0
1939	227,131	345,726	246,800	124,830	193,168	25,2
1940	328,731	368,709	206,800	134,429	198,163	85,6
1941	620,403	681,650	146,000	[3] 139,505	[3] 204,608	224,6

[1] Bureau of Mines not at liberty to publish value.
[2] Includes selenium salts.
[3] Figures cover January to September, inclusive.

Selenium, in conjunction with cadmium, is imp
colorant in ruby glasses for signal lenses, tail lights
tableware. Antithetically, selenium acts as a decol
per ton of glass imparts a pink that cancels the green
rities and thereby yields a virtually colorless proc
quantities of selenium are used in rectifiers and lig
and for flameproofing wire and cable insulation. Add
or tellurium have been found to increase the ductility
nese steels and to improve machinability of stainless
alloys. Augmented demand for tellurium is princip
stabilizer in cast iron. Tellurium is also called upon
and rubber. Tellurium-lead work-hardens and is r
even at high temperatures.

TITANIUM

Soon the United States will attain self-sufficiency
eral—ilmenite—through development of the Adiron
magnetite deposits, which was begun in 1941. The
of the necessity to discontinue the practice of impor
dred thousand tons of ilmenite annually from In
space was needed for the transportation of other o
essential to the victory program. Rutile from A
somewhat more fortunate situation, for ships delive
in the South Pacific loaded ores for the return vo
pigments were in great demand during 1941. The Na
purchased about 2,500 tons in that year, and individ
tons for aircraft camouflage lacquer and 350 tons to
of a single airplane plant were reported.[30] Such mili
prevented the paint industry from obtaining much r
cent of its needs for civilian consumption and forc
to use less titanium dioxide and more white lead.[3

[29] Hofmann, Wilhelm, and Hanemann, Heinrich, Work Hardening and Precip
Tellurium Alloys: Ztschr. Metallkunde, vol. 33, February 1941, pp. 62–63; Metall
July 1941, pp. 110,112.
[30] Corddry, G. W., Titanium and the Present-Day Situation: Paint Ind. Mag.
1941, pp. 370–372.
[31] Business Week, No. 637, November 15, 1941, pp. 42, 44–45.

ments were put under allocation by Office of Production Management General Preference Order M–44, effective December 1, 1941. Subsequent amendments moved the effective date to January 1, 1942, clarified the original text, and increased from 20 percent to 25 percent (effective February 1, 1942) the proportion of titanium pigments that had to be set aside by producers for direct allocation by the War Production Board. No price action on titanium pigments was taken during 1941, but to stem a proposed advance the Office of Price Administration, on January 2, 1942, requested the stabilization of prices at levels of October 1, 1941, and 2 months later made the informal request mandatory by issuing Price Schedule 98, effective March 1, 1942.

Domestic production.—Ilmenite and rutile were produced in Arkansas, Florida, and Virginia during 1941, mining of ilmenite in North Carolina was begun early in 1942, and plans were made to work titanium ore near Elma, Wash. The Bureau of Mines is not at liberty to publish figures showing domestic production of titanium ores. Ilmenite concentrates shipped from domestic mines in 1941 contained 42 to 54 percent TiO_2, and rutile concentrates contained 92 to 95 percent TiO_2. The geology of the Virginia titanium deposits was described in some detail by Ross.[32] The most significant feature of the 1941 titanium picture was the plan to exploit the Adirondack titaniferous iron ores. Mining will be begun in the summer of 1942, and at full capacity the project will enable the United States to be virtually self-sufficient in supplies of ilmenite. The property is being developed by the Titanium Division, National Lead Co., and the following details are abstracted from a comprehensive report by I. D. Hagar,[33] general manager.

In the Adirondack Mountains at Newcomb, Essex County, northeastern New York, a titaniferous iron-ore deposit, known as the MacIntyre Development, is being opened up by the National Lead Co. to obtain titanium for use in pigments. Purchased were some 7,000 acres, including the Sanford Hill deposit, located on the east shore of Lake Sanford, and the Iron Mountain deposit, about 1½ miles to the northeast. The National Lead Co. offered through the Office of Production Management to make a part of the output available to any pigment producer who would finance the requisite additional facilities. In this manner the Krebs Pigment & Chemical Division of E. I. du Pont de Nemours & Co., Inc., acquired an interest in the development and will receive one-fourth of the production for 10 years. The program of operation calls for a daily mine output of 5,500 long tons of ore analyzing 16 percent TiO_2, from which the mill will produce 800 long tons of ilmenite concentrates containing about 48 percent TiO_2. In addition, there will be a byproduct of approximately 1,800 tons daily of low-phosphorus magnetite. There is some question as to the ready marketability of this concentrate, since it will contain about 10 percent TiO_2, the effects of which in a blast furnace constitute a controversial question. However, much interest is being expressed by various steel manufacturers in the possibility of utilizing this magnetite, in spite of the alleged handicap. Beginning in May 1941, a core-drilling program involved the extraction of over 11,000 feet of diamond-drill cores from 70 drill holes. Examination of these cores showed that there is available in the Sanford Hill deposit above lake level approximately 15,000,000 tons of ore analyzing 16 percent TiO_2. This quantity is estimated to constitute a sufficient supply for the domestic pigment industry for at least 10 years.

The mine will be of the open-pit or bench-type, utilizing churn drills and electrically operated shovels to load the broken ore on heavy-duty mine trucks for haulage to the mill. The mill will contain the following units: (1) The crushing plant, equipped with a 48- by 60-inch jaw crusher, a 5½-foot standard cone crusher, a 5½-foot shorthead cone crusher, and attendant

[32] Ross, Clarence S., Occurrence and Origin of the Titanium Deposits of Nelson and Amherst Counties, Va.: Geol. Survey Prof. Paper 198, 1941, 59 pp.

[33] Hagar, I. D., Titanium and the MacIntyre Development: Paint Ind. Mag., vol. 61, No. 12, December 1941, pp. 410–418.

See also, Oliver, Frank J., Titaniferous Adirondack Ores Being Reworked: Iron Age, vol. 149, No. 10, March 5, 1942, pp. 53–59.

(2) The wet mill, which will contain the crushed-ore bins, ant elevators, screens, and pumps, 12 Crockett wet-belt s the magnetite, 96 wet-concentration tables for separati units for dewatering the concentrates. (3) The dry mill battery of steam coil driers, operated by two 500-hp. b dry magnetic separators. Cost of development is es Materials for the entire development were made availab by the Office of Production Management of a blanket A Certificate, one of the highest blanket priorities granted enterprise not directly engaged in the manufacture of we

Foreign trade.—Imports of titanium ore and fe years are shown in the accompanying table. Of of ilmenite imported during the first 9 months of 1 from British India, 3 percent from Canada, and Brazil and Portugal. Imports of rutile during the ing the rutile in zircon-rutile concentrates from mated at 4,000 short tons—78 percent from Aus from Brazil. Exports of titanium pigments fro were 5,950 short tons during the first 9 months the corresponding period of 1940. Such exports the 12 months of 1940 compared with 4,319 in 19

Titanium ore[1] *and ferrotitanium imported for consumpti 1937–41*

Year	Titanium ore			
	Ilmenite		Rutile[1]	
	Long tons	Value	Short tons	V
1937	153, 903	$770, 757	665	$
1938	209, 174	1, 018, 403	230	
1939	255, 872	1, 126, 200	442	
1940	197, 864	750, 590	156	
1941 (Jan.–Sept.)	139, 944	574, 651	[1] 930	[1]

[1] Excludes rutile in zircon-rutile concentrates from Australia; such impor 3,000 tons from January to September 1941.

Prices.—Quotations for ilmenite, 50–60 perce long ton were replaced in February by prices o 60-percent material, which held throughout 194 and Mineral Markets. Rutile, 88–90 percent T April to $95 a short ton, and 94-percent concentr cents a pound during all of 1941. Titanium met listed at $5–$5.50 a pound. Throughout 1941 titanum at $1.23 per pound of contained Ti for 4 and $1.35 for 20- to 25-percent grade, and ferroc percent Ti, at $142.50 a short ton for 6- to 8-perce for 3- to 5-percent carbon. The base price of 13½–15½ cents a pound during the first half of 1 Paint and Drug Reporter, but at the beginning 14½–16½ cents, at which level it was fixed b previously noted.

Uses.—Most of the titaniu m supply is consum paper, rubb er, leather, cer. mics, plastics, lin textiles, cosmetics, soap, and welding-rod coa

goes into titanium ferro-alloys, hard-cutting alloys, other nonferrous alloys, and metallic titanium. Domestic production of titanium pigments has more than doubled since 1938 and, according to Chemical and Metallurgical Engineering, approached 165,000 short tons in 1939. Titanium white paints are noted for a high degree of opacity, reflectance, and durability. Titanium dioxide makes it possible to manufacture workable porcelain enamels with a higher degree of acid resistance than can be obtained by any other means; at the same time, a remarkable degree of opacity in developed and gloss is improved.[34] Ilmenite is the source of all titanium pigments and also enters into the production of alloys and welding rods. By far the largest use of rutile is as a flux in welding-rod coatings, where its function is to shield the arc from oxidation during welding and to produce a brittle slag, which protects the cooling weld deposit.[35] The second most important use of rutile is in steel manufacture, where ferrotitanium and ferrocarbontitanium act as strong deoxidizers (to some extent replacing aluminum) and as addition agents to inhibit intergranular corrosion of stainless steels and air-hardening of 5-percent chromium steels.[36] A new type of permanent magnet contains 6 to 12 percent titanium.[37] Rutile is also used in ceramics and a number of nonferrous alloys, particularly titanium-aluminum, which improves the grain of aluminum castings. Titanium carbide is a constituent of hard alloys used in machine tools. A comprehensive Russian technical article on this application has recently been translated.[38] The use of metallic titanium has been limited principally to radio tubes. Titanium deserves study as a structural material, although it is difficult to produce metal free from objectionable oxygen and nitrogen.[39] Traces of metallic titanium in mercury boilers inhibit corrosion and facilitate heat transfer. Titanium tetrachloride is utilized in smoke screens and in purifying aluminum alloys.

WORLD PRODUCTION

Australia.—Zircon Rutile, Ltd., Byron Bay, New South Wales, increased its production of zircon-rutile concentrates in 1941.[40] The International Titanium Corporation, controlled by the American Rutile Corporation and Ventures, Ltd., of Canada, began producing concentrates of rutile and zircon in New South Wales in June 1941 and shipping the material to Carteret, N. J., for further separation.[41] Titanium minerals and zircon are also being recovered from black sands at Lower Piper River near Low Head, on the northern coast of Tasmania.[42]

Brazil.—During the first 9 months of 1941, Brazil exported 2,621 metric tons of ilmenite and 1,462 metric tons of rutile. All the ilmenite and 57 percent of the rutile were shipped to the United States.

[34] Tinsley, S. G., Titanium Oxide as an Ingredient of Porcelain Enamel Frits: Ceram. Ind., vol. 38, No. 3, March 1942, pp. 36–39.
[35] Johnston, J. Murray, Rutile and Zircon: Am. Inst. Min. and Met. Eng., Ann. Meeting, New York, N. Y., February 11, 1942, 3 pp.
[36] Steel, Modern Contributions of Titanium to Steel Production: Vol. 109, No. 18, November 3, 1941, pp. 96, 110–111.
[37] Howe, Goodwin H. (to General Electric Co.), Alloys for Permanent Magnets: U. S. Patent 2,264,038, November 25, 1941; Chem. Abs., vol. 36, No. 6, March 20, 1942, p. 1585.
[38] Meerson, G. A., and Lipkes, Ya. M. (Hard Metal Alloys, Tungsten Carbide—Titanium Carbide—Cobalt Mixtures): Zhurnal Prikladnoy Khimii, No. 12, 1939, p. 1759 ff. Trans. by W. D. Jones, Metal Ind., vol. 59, No. 19, November 7, 1941, pp. 290–293; No. 20, November 14, 1941, pp. 306–308.
[39] Dean, R. S., Progress Reports—Metallurgical Division. 50. Annual Report of the Metallurgical Division, Fiscal Year 1941: Bureau of Mines Rept. of Investigations 3600, 1941, pp. 52–53.
[40] Industrial Australian and Mining Standard, vol. 96, No. 2478, September 15, 1941, p. 211; vol. 96, No. 2479, October 1, 1941, p. 225.
[41] Northern Miner, vol. 27, No. 45, Jan. 29, 1942, p. 9.
[42] Mining Journal (London), vol. 214, No. 5535, September 20, 1941, p. 428.

World production of titanium concentrates (ilmenite in metric tons

(Compiled by B. B. Waldt

Country	1936	193
Ilmenite:		
Australia:		
New South Wales		
South Australia		
Brazil (exports)	9	
Canada (shipments)	2,328	3
Egypt	24	
Federated Malay States (exports)	10,376	6
India, British	141,327	182
Norway	67,194	84
Portugal	183	1
Senegal	[2] 3,227	
United States	[3]	[3]
Rutile:		
Australia: New South Wales	[1]	[4]
Brazil (exports)	768	
Cameroun (French)	55	
Norway	198	
South-West Africa	54	
United States	[3]	[3]

[1] Data not available.
[2] Exports.
[3] Bureau of Mines not at liberty to publish figures.
[4] Includes 72 tons of mixed rutile-ilmenite concentrates.

Canada.—Ilmenite production from S in 1941. Other titaniferous iron deposits may contribute to the 1942 output.[43] by Canada in 1940 totaled 3,069 short United States.[44]

Norway.—Titanium deposits were rep as a result of a systematic survey condu man geologists and engineers.[45]

ZIRCONIUM

Zircon is recovered from beach sands Riz Mineral Co. as an accessory of titani Lincoln, Calif., by the Fay Placers Mini dredging. Although domestic productio 1927, there was none from 1929 to 19 small during 1940 and 1941 but was incre Some work was done on a zircon depos Imports of zirconium ore and zirconiu are shown in the accompanying table during the first 9 months of 1941 totaled from Australia, 24 percent from Brazil, India. Some comments on the Australia the foregoing titanium discussion in t zirconium ore is essentially baddeleyite percent) approximately 1½ times that and Chambers [46] have described the depo

[43] De Mille, John B., Mining in Quebec During 1941: Canad p. 85.
[44] Foreign Commerce Weekly, vol. 6, No. 7, February 14, 194
[45] Chemical and Metallurgical Engineering, German Aid Producing Synthetics in Europe: Vol. 48, No. 12, December 1
[46] Melzer, W., and Chambers, G. H., Zirconia in Brazil: Fo 24–26.