UNITED STATES DEPARTMENT
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BUREAU OF MI
JOHN W. FINCH, Dire

MINERALS YE

1937

Compiled under the supe
H. H. HUGHE
Economics and Statistic

UNITED STATE
GOVERNMENT PRINTIN
WASHINGTON : 1

For sale by the Superintendent of Documents, Wash

LEAD [1]

By Elmer W. Pehrson and

SUMMARY OUT

The lead industry made further strid
marked recovery in industrial activity.
prices were substantially above those in 1
was made in liquidating the huge sto
depression. In short, the industry enj
A feature of 1936 was the notable incre
covering and building, although impr
still lags far behind that in other import

Salient statistics of the lead industry in the U
1932–36, in short

	1925–29 (average)	1932
Production of refined primary lead:		
From domestic ores	660, 525	r 248, 9
From foreign ores and base bullion	123, 104	33, 0
	783, 629	r 281, 9
Recovery of secondary lead:		
As pig lead	126, 600	128, 0
In alloys	153, 400	70, 3
	280, 000	198, 3
Total production of pig lead (primary and secondary)	910, 229	r 409, 9
Imports: [2]		
Lead in base bullion	95, 747	13, 4
Lead in ore	40, 096	21, 0
Exports of refined pig lead	98, 048	23, 5
Refined primary lead available for consumption	r 690, 916	r 264, 8
Estimated consumption of primary and secondary lead	900, 250	416, 7
Prices:		
New York:		
Average for year cents per pound	7. 47	3.
Quotation at end of year do	6. 25	3.
London average do	5. 87	1.
Mine production of recoverable lead	664, 230	292, 9
World smelter production of lead	1, 850, 000	1, 279, 0

r Revised figures.
[2] Data for 1934–36 include lead imported for immediate co
under bond as do figures for earlier years.
[3] Subject to revision.

[1] This report deals primarily with the smelting, refining, a

Virtually all gains in 1936 were made in the second half of the year. From January to July domestic shipments failed to maintain the level established during the closing months of 1935, and in consequence stocks increased. Despite this, however, the price advanced from 4.50 cents a pound (New York) at the beginning of the year to 4.60 cents toward the end of February. This quotation held until October. Beginning in July demand became stronger not only in the United States but in Europe, where speculative buying in anticipation of the enormous rearmament program announced by the British Government was a leading factor. London prices reacted immediately, but the New York quotation did not advance appreciably until the last of October. Although New York prices rose sharply during Novem-

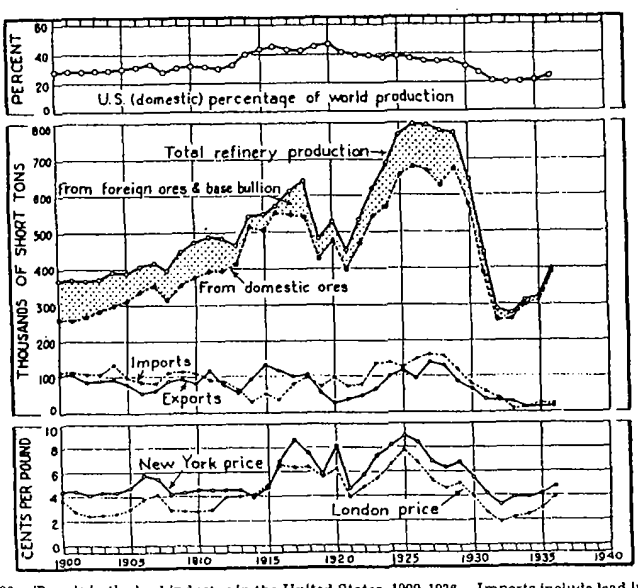

FIGURE 26.—Trends in the lead industry in the United States, 1900-1936. Imports include lead in ore, base bullion, and refined lead; exports include refined lead.

ber and December London prices rose faster, and by December exceeded those in New York for the first time since the World War. The differential between London and New York moved from 1.20 cents per pound in favor of New York in June to 0.03 cent in favor of London in December. At times during December it would have been profitable to export domestic lead to Europe, but apparently little or no lead was exported. At the close of the year quotations were 6.03 cents in New York and 6.21 cents in London. Domestic shipments exceeded production during the last half of the year by 60,000 tons. Figure 26 shows trends in the domestic lead industry from 1900 to 1936.

At the end of 1936 stocks of refined lead on hand in the United States totaled about 165,000 short tons, or approximately a 3-month supply. Although this is considerably above normal, price movements in the latter part of 1936 showed that the stocks were strongly

held and did not necessarily constitute a s
price appreciation. Moreover, these ex
value to the industry early in 1937, as the
in preventing exorbitant prices, which m
have been detrimental to the industry in
Outside the United States recovery ov
consumption was not so pronounced. P
duction increased 23 percent, whereas th
percent. Consumption likewise was 20 p
States and only 7 percent higher elsewh
depression levels, however, domestic co
considerably, being approximately a third
it was 12 percent above. The more favo
was due to the smaller stocks held abro
started, cessation of supplies from Spain
threatened curtailment elsewhere on accou

Trends in lead consumption.—Figure
lead consumption from 1929–36 with that
the general index of industrial activity.

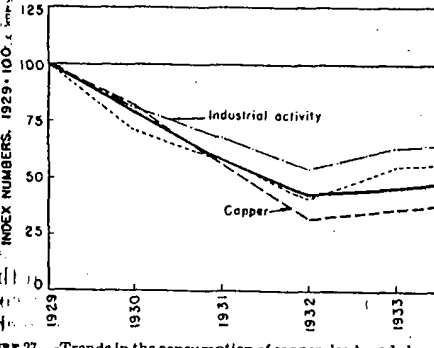

FIGURE 27.—Trends in the consumption of copper, lead, and zinc
activity, 1929-36. Indexes shown for industrial activity comp
Consumption data from American Bureau of Metal Statistic

Industrial activity and zinc consumption
lead and copper consumption. Zinc co
tivity in 1936 were 92 and 88 percent
totals whereas lead and copper consumpt
the 1929 averages. The more favorabl
rimarily to the fact that most of the c
oods, production of which has progress
osperity. On the other hand, lead and
urable goods, and the hesitancy with whi
new plant and equipment has retarde
rticularly in the utility and building field
The effect of slow recovery in the utility
nsumption of lead is shown in figure 28.
tensively in the communications field
ost important uses for lead. In 1929 it
one (23 percent) of the total lead consume
lead, however, was the hardest hit of
ming industries during the depression

declined to 31,400, and since then has increased to only 61,400 tons most of the advance was credited to 1936, in which year cable coverin consumed 10 percent of the total. The use of lead in building likewis has slumped severely—from 96,000 tons in 1929 (10 percent of th total) to 22,000 tons in 1932 with a subsequent rise to only 40,000 ton in 1936. Consumption of lead for all other purposes, which include pigments, storage batteries, ammunition, foil, alloys, etc., has im proved surprisingly; the tonnage used in 1936 was 81 percent of the 1929 total. These purposes took 84 percent of all the lead used in 1936 compared with only 67 percent in 1929. Obviously, however full return of lead consumption to predepression levels requires sub stantial improvement in the building and utility fields.

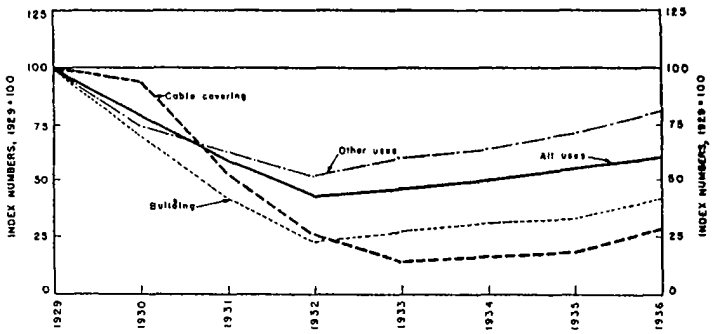

FIGURE 28.—Comparison of trends in consumption of lead in cable covering, building, and other uses with total lead consumption, 1929–36. Data from American Bureau of Metal Statistics.

DOMESTIC PRODUCTION

Refined pig lead produced in the United States is derived from three main sources—domestic ore, foreign ore and base bullion, and secondary materials. The following table lists the production from each of these sources from 1927 to 1936.

Total pig lead produced in the United States, 1927–36, in short tons

Year	From domestic ores and base bullion	From foreign ores and base bullion	From secondary materials	Total
1927	668,320	128,210	119,000	915,53
1928	626,202	154,869	138,000	919,07
1929	672,498	102,135	138,500	913,13
1930	573,740	99,293	129,000	772,03
1931	390,260	52,504	128,800	571,56
1932	[1] 248,917	33,024	128,000	[1] 409,94
1933	[1] 249,713	13,963	131,800	[1] 395,47
1934	299,841	11,395	124,500	435,73
1935	310,505	14,055	156,800	481,36
1936	387,698	11,458	137,500	536,65

[1] Revised figures.

PRIMARY LEAD

Refinery production.—Production of refined primary lead in 193 increased 23 percent; it was equivalent to the production in 1905 bu was 49 percent below the 1925–29 average. The production of lea

rived from domestic ores increased abou production from foreign ores and base bullio was equivalent to only 11 percent of the 1 only 3 percent of the total output of refin

Refined primary lead produced in the Unit

Year	Production (short tons)				Sources	
	Desilverized lead [1] [2]	Soft lead [2]		Total production [1]	From domestic ores and base bullion	fo
		Desilverized	Undesilverized			
29	483,622	55,666	235,345	774,633	672,498	2
30	396,094	45,578	201,361	643,033	573,740	3
31	263,919	40,456	138,389	442,764	390,260	2
32	189,707	[r] 29,104	63,130	[r] 281,941	[r] 248,917	2
33	165,791	[r] 12,307	85,578	[r] 263,676	[r] 249,713	
34	186,468	22,744	102,024	311,236	299,841	1
35	192,544	35,233	96,783	324,560	310,505	1
36	239,944	47,462	111,750	399,156	387,698	1

[1] The lead content of antimonial lead is excluded (see p. 176).
[2] Desilverized soft lead is excluded.
[3] Includes lead derived from Missouri ores and other nonargentifer
[r] Revised figures.

Source of primary lead.—Of the total refin percent was derived from domestic ores a ores. Production from foreign ores decrea in 1928 more than 128,000 tons of foreign b United States; in 1936 such refining virtuall ources of lead derived from domestic ores a Line Production.

Refined primary lead produced in the United States, 19

Source	1929	1930	1931	1932
Domestic ore	672,498	573,740	390,260	[r] 248,917
Foreign ore:				
Australia	5	3		30
Canada	9,499	14,309	3,816	3,797
Europe	23	41	43	4,491
Mexico	16,807	14,949	6,420	334
South America	3,285	3,476	2,299	2,631
Other foreign	51	1,510	9,076	10,464
[illegible]	29,075	34,348	22,254	21,747
Foreign base bullion:				
Mexico	51,295	18,592	30,072	11,164
South America	21,165	16,353	178	113
[illegible]	72,460	34,945	30,250	11,277
Total foreign	102,135	69,293	52,504	33,024
Grand total	774,633	643,033	442,764	[r] 281,941

[r] Revised figures.

Antimonial lead.—Antimonial lead or h byproduct of the refining of base bullion, rom this source is only a small part of the co

and some is produced by mixing metallic antimony with refined lead.

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

Antimonial lead produced at primary lead refineries, 1929-36

Year	Production (short tons)				Antimony content		Lead content by difference (short tons)			
	From domestic ore	From foreign ore	From scrap	Total	Short tons	Percent	From domestic ore	From foreign ore	From scrap	Tot[illegible]
1929	17,062	8,607	17,575	43,244	4,935	11.4	(1)	(1)	(1)	38,[illegible]
1930	8,918	4,793	11,080	24,707	2,967	12.0	(1)	(1)	(1)	21,[illegible]
1931	(2)	(2)	(2)	21,842	2,438	11.2	3,628	1,003	14,173	19,[illegible]
1932	(2)	(2)	(2)	21,024	2,495	11.9	3,577	1,466	13,486	18,[illegible]
1933	(2)	(2)	(2)	17,805	1,720	9.7	4,158	791	11,136	16,[illegible]
1934	(2)	(2)	(2)	16,607	2,263	13.6	5,901	330	8,113	14,[illegible]
1935	(2)	(2)	(2)	16,384	1,729	10.6	4,686	491	9,479	14,[illegible]
1936	(2)	(2)	(2)	23,230	2,162	9.3	7,442	696	12,930	21,[illegible]

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

SECONDARY LEAD

Recovery of secondary lead decreased 3 percent in 1936. Retu[illegible] of battery scrap for smelting and refining was 10 percent less than 1935, and stocks of scrap were considerably lower at the end of [illegible] year. As the output of domestic refined primary lead was 25 perc[illegible] higher, the ratio of secondary- to primary-lead production declin[illegible] from the record high of 87 percent in 1935 to 68 percent in 1936. [illegible] lead consumption continues to increase, further declines in this ra[illegible] may be expected, as additional supplies of the metal will have to co[illegible] largely from the mines. Further details on secondary-lead producti[illegible] in 1936 are given in the chapter on Secondary Metals.

Secondary lead recovered in the United States, 1929-36

[Compiled by J. P. Dunlop]

Year	Pig lead (short tons)—			Lead in alloys (short tons)	Total recovered lead		
	At primary plants	At secondary plants	Total		Short tons	Value	Ratio [illegible] domest[illegible] refined p[illegible] mary le[illegible] (percen[illegible])
1929	65,350	73,141	138,500	172,500	311,000	$39,186,000	[illegible]
1930	48,135	80,865	129,000	126,800	265,800	25,580,000	[illegible]
1931	43,774	85,026	128,800	105,900	234,700	17,367,800	[illegible]
1932	33,611	94,389	128,000	70,300	198,300	11,898,000	[illegible]
1933	41,632	90,168	131,800	92,700	224,500	16,613,000	[illegible]
1934	33,557	90,943	124,500	83,900	208,400	15,421,600	[illegible]
1935	44,748	112,052	156,800	113,600	270,400	21,632,000	[illegible]
1936	34,656	102,944	137,500	125,400	262,900	24,186,800	[illegible]

LEAD PIGMEN[illegible]

Lead pigments manufactured in 193[illegible] [illegible], an increase of 11 percent over 1935 [illegible] were derived from refined pig lead, [illegible] 44 percent, litharge 40 percent, red l[illegible] [illegible] and orange mineral 1 percent. Su[illegible] [illegible]de are the principal pigments in whic[illegible] [illegible] ores.

Lead in pigments,[1] 1929-36, by s[illegible]

Year	Lead in pigments from—				Ye[illegible]
	Domestic ore[2]	Metal	Scrap	Total	
[illegible]	9,429	248,657	2,427	260,513	1933
[illegible]	6,686	190,182	689	197,557	1934
[illegible]	5,722	166,328	710	172,760	1935
[illegible]	4,932	127,318	262	132,512	1936

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

MINE PRODUCT[illegible]

Mine production of recoverable lead [illegible] [illegible]ease of 13 percent over 1935; it was [illegible] 1925 to 1929. Missouri, Idaho, an[illegible] [illegible]cipal sources and contributed 30, 24, [illegible] the total production. Missouri's outp[illegible] [illegible]souri district contributed 108,422 to[illegible] [illegible], Idaho's 16 percent, and Utah's 10 [illegible] State district increased 11 percent [illegible] the 1936 total. Among the minor pro[illegible] [illegible]ona, and Colorado contributed larg[illegible] [illegible]. Production in Nevada and Ne[illegible] [illegible] that in 1935. Further details of p[illegible] States can be found in the various S[illegible]

Mine production of recoverable lead in the United States, 1925–29 (average) an... 1930–36, in short tons

State	1925–29 average	1930	1931	1932	1933	1934	1935	1936
Western States and Alaska:								
Alaska	982	1,365	1,661	1,261	1,157	840	670	1
Arizona	9,743	4,246	982	1,182	1,721	3,439	7,783	1 10,
California	2,070	1,780	1,879	1,209	381	412	507	1
Colorado	30,112	22,130	6,884	2,150	2,402	4,218	5,673	7,
Idaho	141,610	134,058	99,305	72,118	74,363	71,324	79,020	91,
Montana	18,871	10,653	4,430	1,079	0,582	10,005	15,589	1 19,
Nevada	9,807	11,529	7,930	440	2,303	10,991	12,676	1 12,
New Mexico	6,730	10,378	11,269	10,114	11,043	9,365	7,289	6,
Oregon	6	5	2	4	5	21	30	
South Dakota	21			4			4	
Texas	213	108		17	3	360	522	
Utah	140,500	115,405	70,212	62,770	58,088	58,077	63,510	69,
Washington	1,323	576	1,380	921	840	291	103	
Wyoming				5		1	3	
	370,997	312,413	215,000	153,280	159,488	169,344	193,439	1 219,
Central States:								
Arkansas	38	53	78	4	10	40	38	
Illinois	552	248	205	31	240	40	430	
Kansas	26,121	12,910	7,082	6,490	6,089	6,805	10,892	11,
Kentucky	135	101			176	104	132	
Missouri	202,240	190,632	100,121	117,159	84,980	90,493	97,493	110,
Oklahoma	58,306	23,052	13,210	10,634	18,038	16,747	23,405	25,
Wisconsin	1,745	1,537	952	910	540	234	286	
	289,137	237,533	181,648	135,228	110,073	114,463	132,682	148,
Eastern States:								
New York								
Tennesssee	4,090	8,367	7,974	4,460	3,116	3,625	4,982	5,
Virginia								
North Carolina								
	4,090	8,367	7,974	4,460	3,116	3,625	4,982	5,
	664,230	558,313	404,622	292,968	272,677	287,432	331,103	1 373,

[1] Subject to revision.

Mine production of recoverable lead in the principal lead-producing districts of ... United States, 1929–36, in short tons

District	State	1929	1930	1931	1932	1933	1934	1935	1936
Southeastern Missouri region	Missouri	197,435	198,622	158,950	116,152	83,970	89,580	96,941	108,
Coeur d'Alene region	Idaho	141,558	129,311	97,771	71,505	73,926	70,331	78,290	86,
Bingham	Utah	40,447	42,586	33,597	32,640	33,030	32,420	36,293	32,
Joplin region	Kansas, Missouri, Oklahoma.	74,143	36,972	21,463	18,131	26,137	24,465	34,849	35,
Park City region	Utah	42,570	30,875	17,368	12,653	11,557	12,360	13,180	17,
Butte	Montana	8,239	2,540		1	4,185	5,391	10,302	
Rush Valley	Utah	11,751	10,157	8,773	7,222	6,916	5,594	4,907	5,
Tintic	do	44,113	20,474	18,427	9,842	6,433	5,715	5,833	7,
Tyho	Nevada	1,991	3,622	4,083		107	4,285	5,519	
Willow Creek	New Mexico	5,720	5,431	7,563	6,449	7,075	6,143	5,162	3,
Pioche	Nevada	2,986	4,868	2,892	74	1,628	4,644	4,955	
Oro Blanco	Arizona	[2]	[2]				1,676	4,717	
San Juan Mountains	Colorado	17,386	11,722	908	792	906	1,651	2,428	3,
Central	New Mexico	3,766	3,936	3,420	3,521	3,408	2,846	1,891	2,
Ophir	Utah	25	18	13	2	87	1,349	2,392	3,
Leadville	Colorado	5,172	6,808	1,470	70	505	524	1,288	1,
Eagle	Montana		1,287	3,489	771	1,521	2,560	1,121	
Banner	Arizona	2,938	929			385	77	857	
Jack Rabbit	Nevada	2,430	1,464	240	14	221	930	849	
Inyo County	California	670	1,711	1,765	1,102	301	277	346	
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	1,536	1,537	952	910	540	234	286	
Bisbee (Warren)	Arizona	1,020	151	252	431	[3]	64	200	
Pend d'Oreille	Idaho	863	956	1,020	676	309	318	189	
Eagle County	Colorado	198	2,821	3,816	221	8	52	155	
Warm Springs	Idaho	1,507	1,793	37		21	8	32	2,
Cedar Plains	Montana	1,177	120	25	2	1	2	7	
Barker	do	6,137	4,578	21		28		22	
Dome	Idaho	1,870	829		1				
San Francisco	Utah	691	1,883	436				42	
Austinville [1]	Virginia	[2]	[2]	[2]	[3]	[1]	[2]	[1]	
Metaline [1]	Washington	328	257	1,257	682	722	237	[2]	
St. Lawrence County [1]	New York		[2]	[2]	[1]	[1]	[1]	[2]	

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

STOC

Lead stocks, as reported by the ...stics, are shown in the following ta... ...onial lead include metal held by ... ...finers of secondary material who ... ...d refined in the United States and ... ...included.

...d stocks at end of year at smelters and ... in short

	1929	1930
...ined pig lead	41,726	95,524
...timonial lead	9,350	7,723
	51,076	103,247
...d in base bullion:		
...At smelters and refineries	8,313	8,171
...In transit to refineries	7,116	4,261
...In process at refineries	16,089	14,368
	31,518	26,800
...ad in ore and matte and in process ...t smelters	28,299	28,697
	110,893	158,744

Substantial progress was made i... ...ocks of refined lead accumulated f... ...hand at the close of the year wa... ...pply at the average rate of dome... ...onths of 1936. Although stocks ... ...e large quantity of metal available ... ...d and early in 1937 aided in prev... ...hen the speculative market reache... ...Virtually no published data are ... ...the United States. The British ... ...iew of the lead industry issued in ... ...re low (less than a 1.5-month su... ...the London price precipitated by ... ...e first few months of 1937 indic... ...from plentiful.

DOMESTIC CO...

New supply.—The following table ... ...ailable for consumption from 19... ...not take into account variati... ...ese have changed considerably dur... ...own do not indicate the true tre... ...lead. The supply available f... ...ent greater than in 1935 but w... ...the 1925–29 average. As total c... ...ent in 1936, it is evident that m... ...plied by primary than by second...

Refined primary pig lead available for consumption in the United States, 1929 and 1931–36, in short tons

	1929	1931	1932	1933	1934	1935	1936[1]
Supply:							
Stock in bonded warehouse Jan. 1	4,139	(1)	(1)	(1)	(1)	(1)	(1)
Imports	1,658	10	44	109	283	1,322	2,590
Production	774,633	442,764	288,361	273,579	311,236	324,560	399,156
	780,430	442,774	288,405	273,688	311,519	325,882	401,746
Withdrawn:							
Exports [2]	73,251	21,605	23,516	22,836	5,009	6,082	18,314
Stock in bonded warehouse Dec. 31	1,328	(1)	(1)	(1)	(1)	(1)	(1)
	74,579	21,605	23,516	22,836	5,009	6,082	18,314
Supply available for consumption	[3] 705,851	[3] 421,109	[3] 264,889	[3] 250,853	[3] 305,610	[3] 318,900	383,432

[1] Stocks of pigs, bars, etc., in bonded warehouse included with base bullion. (See table on p. 183.)
[2] Includes small quantities of foreign lead reexported.
[3] Revised figures.

Consumption by uses.—Owing to the large return of secondary lead from 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, 1929–36.

Lead consumed in the United States,[1] 1929–36, in short tons

Purpose	1929	1930	1931	1932	1933	1934	1935	1936
White lead	119,700	83,900	77,500	54,500	59,100	64,500	80,000	85,500
Red lead and litharge	30,000	32,000	18,000	32,000	38,000	42,000	47,500	54,000
Storage batteries	210,000	103,000	157,000	138,000	147,000	163,000	175,000	191,000
Cable covering	220,000	208,000	117,000	55,500	31,400	35,200	38,900	61,400
Building	96,000	67,000	40,000	22,000	26,000	30,000	32,000	40,000
Automobiles	18,000	11,000	6,000	3,500	5,000	7,300	10,000	11,100
Railway equipment	5,700	5,200	1,000	300	200	1,100	500	2,400
Shipbuilding	300	500	400	200	100	200	200	200
Ammunition	41,100	33,300	20,700	23,300	32,300	34,800	29,200	32,500
Terneplate	4,200	2,700	2,200	1,400	2,500	2,600	4,700	6,200
Foil	30,800	26,000	20,000	14,000	22,500	16,200	15,900	28,500
Bearing metal	33,000	20,000	12,000	10,000	11,400	12,100	13,000	16,500
Solder	37,000	27,000	20,500	14,000	16,000	16,000	20,000	22,000
Type metal	18,000	16,000	14,400	10,800	11,000	13,000	15,000	17,000
Calking	31,500	21,000	15,000	10,000	12,000	10,000	12,000	13,500
Castings	18,000	12,000	7,000	5,000	5,000	5,000	5,000	5,750
Other uses	50,000	40,000	30,000	22,200	30,000	35,000	40,000	46,000
	972,300	768,600	567,700	416,700	449,500	488,000	538,900	633,500

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

The total industrial use of lead increased 18 percent in 1936 but was still 35 percent below the 1929 record. All major uses increased in 1936 over 1935, and percentage gains for cable covering and building showed up exceptionally well. Compared with 1929, however, these two uses still lag far behind. The increased use of lead in foil was due partly to greater use of lead-tin foil in cigar wrappings, for which it is especially suitable because of its resistance to corrosion from the alkaloids in the tobacco. The added resistance to corrosion and strength of tellurium lead are increasing the use of this alloy.

To assist the consumer in obtaining lead products of standard quality, the Lead Industries Association has adopted a Seal of Approval, effective January 1, 1937. The seal is available to manufacturers whose products meet the standards set up by the association for lead pipe, lead traps, and bends.

PRICES

The two major markets for lead in th
and St. Louis; much of the lead produc
at prices based on quotations in these m
tions are influenced to some extent by t
ing on the London market, so that the N
the St. Louis price by as much as the
0.35 cent a pound.

The New York quotation for lead in
pound, an increase of 16 percent over
and 31 percent below the 1929 average o
of the year the price stood at 4.50 cent
latter part of February, when it was ra
substantial increase in stocks during th
quent decline following active buying in
there was no further change in price
shipments approached predepression a
close of the year the price was carried
domestic consumption at high levels, t
by shut-downs due to strikes at some m
market in London. On December 31
highest since February 1930.

Average monthly and yearly quoted prices of lead 1934–36, in cents pe

Month	1934			
	St. Louis	New York	London	St Lou
January	3.90	4.00	2.55	3.
February	3.90	4.00	2.61	3.
March	3.90	4.00	2.63	3.
April	4.05	4.18	2.65	3.
May	3.99	4.14	2.52	3.
June	3.82	3.98	2.49	3.
July	3.63	3.77	2.43	3.
August	3.60	3.75	2.45	4.
September	3.54	3.69	2.32	4.
October	3.51	3.66	2.28	4.
November	3.42	3.57	2.32	4.
December	3.45	3.60	2.28	4.
Average	3.73	3.86	[1] 2.46	3.

[1] St. Louis: Metal Statistics, 1937, p. 399. Average daily Louis (open market), as reported daily in the American Me
New York: American Metal Market, daily issues. Pig le ment from West.
London: Metal Statistics, 1937, p. 403. Average price of in Metal Statistics, converted to cents per pound at average Board.
[1] London quotations in pounds sterling per long ton, a £14.2375; 1936, £17.6000.

The London quotation for 1936 (U averaged 3.91 cents per pound, the hi ential between New York and London pound in favor of New York. Durin however, the price advance in London New York owing to a more favorable s of supplies from Spain caused by the civ

ment elsewhere on account of labor troubles. In consequence, London set the pace in the upward swing, and by December the London quotation actually exceeded the New York. At times the differential in favor of London was high enough to make exportation from the United States profitable. On December 31, the London quotation was equivalent to 6.21 cents per pound, compared to 6.03 cents at New York.

FOREIGN TRADE [2]

The foreign trade of the United States in lead consists largely of imports of ore and base bullion, which are smelted and refined in bond, and the export of this lead either as refined lead or in manufactured products. Since 1927, however, this trade has declined. In 1936 only 23,615 short tons of lead in ore, base bullion, and refined and scrap lead were imported, compared with 161,389 tons in 1927; exports of refined lead decreased from 125,267 to 18,314 tons. During the same period lead exported in manufactures with benefit of drawback declined from 12,004 to 7,735 tons.

Imports.—Total imports of lead in ore and matte, including imports for immediate consumption and entries for warehouse, increased slightly. Larger receipts from Mexico, Canada, and Peru were offset by smaller shipments from Newfoundland and Chile. Imports of base bullion virtually ceased, but imports of refined lead, which for several years were only a few hundred tons, increased to 2,590 tons in 1936. Total imports of lead decreased 2 percent and were only 20 percent of the 1929 total.

Total lead imported into the United States, 1930–36, by classes, in short tons [1]

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1930	39,377	38,630	209	78,216
1931	20,888	32,320	[2] 10	53,218
1932	21,001	13,462	44	34,507
1933	5,958	1,587	109	7,654
1934	10,611	2,450	283	13,344
1935	20,025	2,692	1,322	24,039
1936	20,713	312	2,590	23,615

[1] Data for 1934–36 include lead imported for immediate consumption plus material entering the country under bond, as do figures for earlier years.
[2] Reclaimed scrap, etc. No imports of pigs, bars, etc., were recorded for 1931.

Total lead imported into the United States, in ore, base bullion, and refined, 1930–36, by countries, in short tons [1]

Year	Canada	Mexico	Newfoundland	South America	Europe	Other countries	Total
1930	17,268	36,721	----------	22,472	113	1,642	78,216
1931	2,618	38,706	9,708	2,171	----------	15	53,218
1932	2,469	13,545	10,598	2,811	5,053	41	34,507
1933	1,629	2,154	----------	1,486	2,368	18	7,654
1934	1,160	3,270	3,357	5,455	67	35	13,344
1935	236	9,786	6,837	6,643	512	25	24,039
1936	1,692	10,601	3,955	6,861	341	265	23,615

[1] Data for 1934–36 include lead imported for immediate consumption plus material entering the country under bond, as do figures for earlier years.

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

Total lead imported into the United States in short

Country	1930
Canada	17,257
Chile	3,318
Mexico	16,341
Newfoundland	----------
Peru	831
Sweden	----------
Other countries	1,635
	39,377

[1] Data for 1934–36 include lead in ore and matte imp
ing the country under bond, as do figures for earlier y

Total lead imported into the United States short

Country	1930	1931
Mexico	20,350	32,210
Peru	18,280	110
Other countries	----------	----------
	38,630	32,320

[1] Data for 1934–36 include lead in base bullion impo
the country under bond, as do figures for earlier years

Lead remaining in warehouses in the Uni

[Stated in the form in which the r

Year	Lead in ore and matte	Lead in base bullion [1]
1930	39,516	5,642
1931	52,849	5,343
1932	42,314	3,769
1933	21,540	1,058

[1] Pigs, bars, sheets, and old included with base bu

Lead imported for consumption in t

Year	Lead in ore and matte [1]		Lead in base bullion	
	Short tons	Value	Short tons	Value
1930	15,458	$1,461,360	10,423	$1,127,920
1931	10,734	1,104,191	10,436	671,002
1932	9,647	863,135	2,574	131,579
1933	19,239	1,164,093	306	31,700
1934	10,760	558,558	2,220	117,729
1935	8,273	258,954	1,154	66,559
1936	5,836	225,568	763	45,340

[1] Classification as follows: Jan. 1, 1929, to June 17,
1936, "Lead in ores, flue dust, and mattes, n. s. p. f."
[2] Reclaimed scrap, etc. No imports of pigs, bars,

Miscellaneous products containing lead imported for consumption in the United States, 1930–36

Year	Babbitt metal, solder, white metal, and other combinations containing lead			Type metal and antimonial lead		
	Gross weight (short tons)	Lead content (short tons)	Value	Gross weight (short tons)	Lead content (short tons)	Value
1930	1,399	530	$503,103	328	275	$32,934
1931	906	310	436,574			
1932	498	191	143,662	6	5	479
1933	340	51	30,623	25	21	1,076
1934	709	102	71,505	112	94	6,784
1935	128	24	44,269	534	445	36,463
1936	334	67	112,205	456	400	34,694

Exports.—Exports of refined lead nearly trebled in 1936, and Mexico and Japan imported virtually the entire increase. Exports credited to Mexico, however, probably represent shipments destined for other countries. Very little, if any, of the lead exported in 1936 was domestic metal.

Refined lead [1] exported from the United States, 1930–36

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)	Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)
	Short tons	Value			Short tons	Value	
1930	48,307	$3,904,213	12,161	1934	5,909	$305,994	7,472
1931	21,665	1,241,881	10,503	1935	6,982	472,017	8,995
1932	23,516	1,069,607	7,220	1936	18,314	1,390,632	7,735
1933	22,835	834,589	6,508				

[1] Includes small quantities of foreign lead reexported.

Refined pig lead [1] exported from the United States, 1930–36, by destinations, in short tons

Destination	1930	1931	1932	1933	1934	1935	1936
COUNTRY							
Argentina	934	226		113	[2]		3
Brazil	874	1,382	750	329	475	338	795
Canada	9	58	132	6	21	45	44
France	3,001	318	224				
Germany	823	52	1,344	5		11	2
Japan	15,053	17,301	20,219	21,230	4,464	5,324	8,628
Mexico	40	171	13	5	21	38	8,049
Netherlands	22	13	112		4	188	
Philippine Islands	543	400	475	300	169	217	223
Sweden	7,557	392					5
United Kingdom	9,157	3	[2]		36	8	123
Uruguay	364	145	84	140	221	112	
Other	9,330	1,204	154	641	508	701	442
	48,307	21,666	23,516	22,835	5,909	6,982	18,314
CONTINENT							
North America	318	435	155	41	107	157	8,289
South America	2,442	1,903	868	736	1,076	668	1,021
Europe	27,899	795	1,793	5	40	212	133
Asia	17,289	18,524	20,700	22,053	4,684	5,945	8,868
Africa and Oceania	359	8			2	[2]	12
	48,307	21,665	23,516	22,835	5,909	6,982	18,314

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

TECHNO

Mining.—The lead industry a
mechanical loading equipment.
Missouri district are now virtuall
basis, and many lead and lead-zinc
States are equipped with mechanica
recently conducted by the Bureau
much interest in mechanical loadin
large potential use.

Stope filling by means of a fre
surface through raises has been
British Columbia. Excess water
stope. The mud is expected to set
of adjacent pillars.

Milling.—A total of 335,889 sh
trates was produced in the United
Tri-State and Wisconsin districts),
of Metal Statistics. The average
compared with 60.19 percent in
According to Pallanch,[4] modern flo
by economic considerations and fr
results are not justified under condi
freight rates, and prices.

A new edition of Flotation Plan
lished in 1936.

Smelting.—Of outstanding inter
lurgy of Lead and Zinc issued ea
actions of the American Institu
Engineers. The book presents a
status of lead metallurgy.

In reviewing the progress of le
points out that increasing supplies
some plants have so reduced the le
bullion has to be recirculated to
advantages of a larger number of
demonstrated at Trail, British Co
at other plants.

A unique process for the simultan
by electrolysis of galena is being t
commercial plant 300 tons of lead
sulphur 99.5 percent pure have
conducted in what is described a
The principal advantage claimed f
it eliminates the sulphur-disposal
Processes used in the recovery of
were described by Thews in the
Chemistry and Metallurgy.

WORLD ASPECTS

International cooperation.—The
under which certain producers

[3] Plein, L. N., Berquist, F. E., and Tryon, F. G
Jour., vol. 138, no. 5, 1937, p. 241.
[4] Pallanch, R. A., Factors Governing the Separat
Met., vol. 17, no. 356, 1936, pp. 386–389.

version into electrolytic zinc. The Norwegian plant operated a capacity throughout 1936. Zinc mining in southern Spain probably has declined considerably.

U. S. S. R. (Russia).—Zinc production increased further in 1936. Plans for a new smelter near Gloubokoie in the Altai district are reported to have been ratified, and at Kirovgrad in the Urals a plant is under construction that will treat annually 250,000 to 300,000 tons of copper slag containing 5 to 6 percent zinc. The U. S. S. R. is now virtually self-sustaining with regard to zinc.

United Kingdom.—The smelter output of zinc increased 3 percent in 1936. The industry is supported largely on foreign ores, imports of which decreased from 152,000 long tons in 1935 to 130,000 in 1936. The decline was mainly in shipments from Australia. As the local smelting industry is inadequate for the needs of the country, large imports of metal are required. Net imports were 174,000 tons in 1936 and 151,000 in 1935. Consumption increased 10 percent over 1935 and totaled 217,000 tons.

The Imperial Smelting Corporation, Ltd., the only zinc-smelting company in the United Kingdom, operated its new vertical-retort plant at Avonmouth at capacity throughout the year. In November the company announced that owing to losses sustained the Seaton Carew smelter had been shut down and that it also purposed closing the Bloxwich plant, which operates largely on scrap. The company was active during 1936 in promoting a renewal of the cartel but insisted that it should be given preferential treatment in the British market. Following the collapse of cartel negotiations in the latter part of the year, the company asked the Government for an increase in the import duty on zinc. Such action, however, would have been difficult in view of the Ottawa agreement. Under a recent trade treaty negotiated with Canada, the British Government is free to impose a tariff on Canadian zinc, on which British consumers depend to a great extent. With the rising market at the close of 1936 and early in 1937, immediate action in this respect seemed improbable. Early in 1937 it was rumored that the Government was acquiring large quantities of zinc.

Yugoslavia.—Trepca Mines, Ltd., treated 600,200 metric tons of ore in 1936, from which 78,100 tons of 50-percent zinc concentrates and 65,700 tons of 80-percent lead concentrates were obtained. The ore averaged about 7 percent zinc, 9 percent lead, and 3.2 ounces of silver per ton. The declining zinc content of the ore in the lower levels of the mine accounts for a 15-percent decline in the production of zinc concentrates. The zinc concentrates are shipped to Belgium and France for smelting. The operations of this company were described in detail in the September to December 1936 issues of Mining and Metallurgy.

LEAD AND ZINC PIGMENTS

By ELMER W. PEHRSON AN

SUMMARY OUT

In consequence of the greater demand atic tires, and storage batteries—a dustries—sales of lead and zinc pig rcent over 1935 in both value and tonn verages, however, sales were still 39 pe percent lower in tonnage, indicating the same extent as production.

Salient statistics of the lead and zinc pigments in (average) and 193

	1925–29 (average)	1932
Production (sales) of principal pigments:		
White lead (dry and in oil) short tons	154,483	66,674
Litharge do	84,845	58,096
Red lead do	41,362	18,880
Zinc oxide do	154,208	72,250
Leaded zinc oxide do	26,609	14,305
Lithopone do	177,745	121,667
Value of products:		
All lead pigments	$60,092,000	$19,133,000
All zinc pigments	41,314,000	19,430,000
Total	101,406,000	38,563,000
Value per ton received by producers:		
White lead (dry)	178	117
Litharge	176	89
Red Lead	193	111
Zinc oxide	133	110
Leaded zinc oxide	124	91
Lithopone	98	84
Foreign trade:		
Lead pigments:		
Value of exports	1,346,000	365,000
Value of imports	30,000	6,000
Zinc pigments:		
Value of exports	2,150,000	466,000
Value of imports	931,000	521,000
Export balance	2,535,000	304,000

Import balance.

Lead pigments again fared better than zinc pigments. Total sales of lead pigments increased 22 percent in value and 16 percent in quantity whereas zinc pigments increased only 5 percent in total value and 13 percent in quantity. Producers of lead pigments received nearly $7 per ton more for their product in 1936 than in 1935, while zinc pigments brought $6 less per ton. Trends in lead pigment quotations during 1936 paralleled those of metallic lead, but prices of zinc pigments did not respond to the sharp increase in the zinc quotation. Prices of the zinc oxides, for instance, were increased only 0.25 cent per

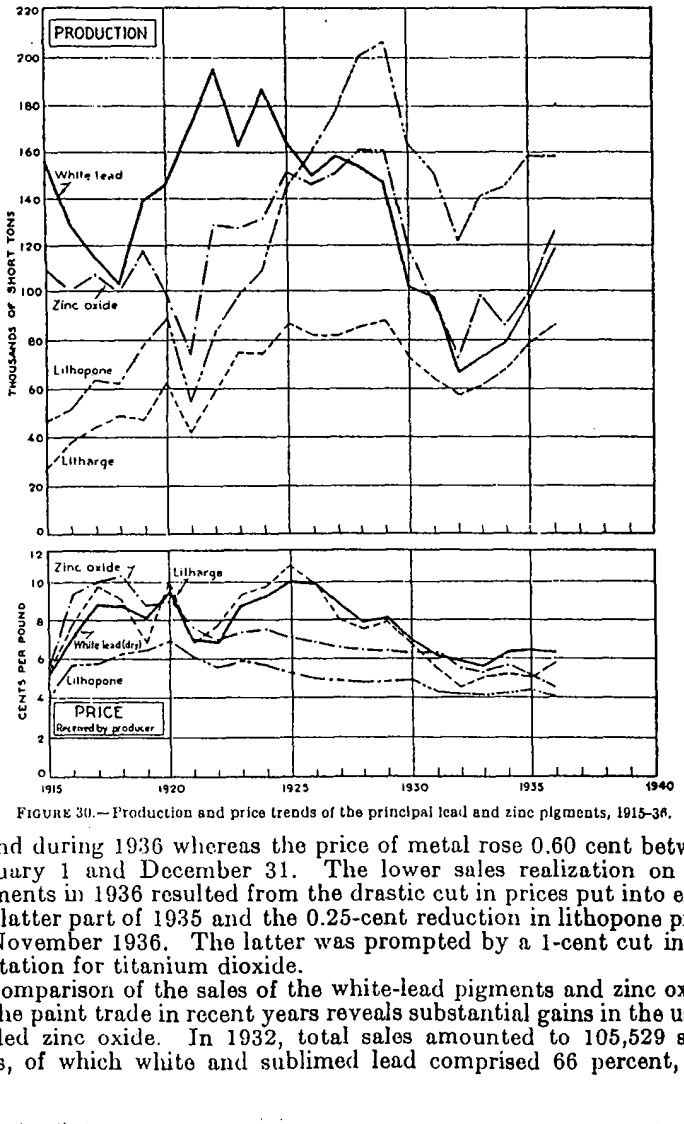

FIGURE 30.—Production and price trends of the principal lead and zinc pigments, 1915–36.

pound during 1936 whereas the price of metal rose 0.60 cent between January 1 and December 31. The lower sales realization on zinc pigments in 1936 resulted from the drastic cut in prices put into effect the latter part of 1935 and the 0.25-cent reduction in lithopone price in November 1936. The latter was prompted by a 1-cent cut in the quotation for titanium dioxide.

Comparison of the sales of the white-lead pigments and zinc oxide to the paint trade in recent years reveals substantial gains in the use of leaded zinc oxide. In 1932, total sales amounted to 105,529 short tons, of which white and sublimed lead comprised 66 percent, zinc

oxide 21 percent, and leaded zinc o
otal sales had increased to 194,762
upplied 62 percent, zinc oxide 17 p
ercent. For the same period the a
igment increased from 23 to 27 perce
Tyler [1] has pointed out the rapid i
igments and their expanding use in fi
y lead and zinc pigments. Much o
uring a period when prices of lea
ven under these conditions titaniu
om the standpoint of low-cost raw m
ource of titanium, was considerably
ecent sharp rises in lead and zinc
here has been no appreciable cha
avored the competitive position o
he drop in the price of lithopone in
narket was significant. Further in
936 suggests a record production o

PRODUC

In this report, sales of pigments an
roduction, as no account is take
eginning and end of the year. Th
heir own plants are included under
The total value of lead and zinc pig
as approximately $62,068,000 in 19
935. The total value of all lead pi
hat of all zinc pigments sold $27,
ncreased 22 percent in total value an
ales of zinc pigments increased 5 per
n quantity. The average value per
s reported by producers, increased o
New York quotation for pig lead incr
ecreased 7 percent in value per
ncrease in the St. Louis quotation fo
Lead pigments.—Production of
mineral, which declined only slightl
white lead increased 22 percent bu
922. Production of litharge was 8
nearly equaled the record output of
hich increased 21 percent in 1936,
roduction of sublimed lead was 1
alues of all lead pigments except w

[1] Tyler, Paul M., Trends in White-Pigment Consum

Lead pigments sold by domestic manufacturers in the United States, 1935–36

Pigment	1935			1936		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulphate or sublimed lead:						
White	7,572	$727,004	$96	7,631	$803,208	$11[illegible]
Blue	727	71,082	99	891	102,585	11[illegible]
Red lead	28,776	3,492,141	121	34,896	4,657,322	13[illegible]
Orange mineral	252	47,515	189	248	48,106	19[illegible]
Litharge	70,030	8,280,339	104	80,246	9,066,663	11[illegible]
White lead:						
Dry	27,972	3,481,988	124	34,775	4,367,337	12[illegible]
In oil [1]	68,859	11,957,171	174	83,632	14,200,617	17[illegible]

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

Lead pigments sold by domestic manufacturers in the United States, 1927–36, in short tons

Year	White lead		Basic lead sulphate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1927	38,669	119,026	13,482	1,061	39,073	709	81,655
1928	42,049	111,923	16,002	1,231	40,497	459	85,570
1929	42,159	104,872	15,580	1,234	43,021	678	87,918
1930	32,548	69,592	10,308	1,219	32,041	356	72,578
1931	30,922	60,446	8,790	896	25,853	282	63,890
1932	19,946	40,728	5,708	540	18,880	212	58,094
1933	24,628	48,364	7,320	626	21,988	231	61,102
1934	22,569	50,165	6,309	608	20,743	234	68,733
1935	27,972	68,859	7,572	727	28,776	252	79,930
1936	34,775	83,632	7,531	891	34,896	248	86,246

Zinc pigments and salts.—Production of zinc oxide and leaded zinc oxide increased 27 and 35 percent, respectively, in 1936, the output of the latter being the highest on record. The tonnage for lithopone represents a decline of 1 percent from 1935, due to a change in the method of compiling statistics. Formerly the combined weights of standard-grade and high-strength lithopone were reported as total sales. Beginning with 1936 the total will include sales of standard grade plus the standard-grade content of the high-strength product. This change reduces the tonnage by the excess quantity of zinc sulphide contained in high-strength lithopone. Production in 1936, compiled on a basis comparable to former years, would show a moderate increase in output over 1935. The Bureau of Mines is not at liberty to publish statistics on the new basis for past years.

The 1936 tonnages were equivalent to the following percentages of the 1929 outputs: Zinc oxide, 79; leaded zinc oxide, 149; and lithopone, 77. Unit values of the oxides decreased substantially in 1936, and that of lithopone was slightly lower.

Zinc pigments and salts sold by domestic manufact

Pigment or salt	1935	
	Short tons	Value (at exclusive of container)
		Total
Zinc oxide [1]	99,097	$10,237,953
Leaded zinc oxide [1]	29,976	2,791,808
Lithopone	159,486	13,470,274
Zinc chloride, 60° B.	(2)	(2)
Zinc sulphate	7,108	324,966

[1] Zinc oxide containing 5 percent or more lead is classed as le
[2] Figures not available.

Zinc pigments and salts sold by domestic manufact
in short tons

Year	Zinc oxide	Le[illegible] z[illegible] ox[illegible]
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	99,097	
1936	126,800	

[2] Figures not available.

CONSUMPTION BY I

White lead.—About 95 percent of the [illegible] in the manufacture of paint. The ton[illegible] 1936 was 24 percent above that in 1935, [illegible] 1929. Consumption of white lead in t[illegible] 45 percent in 1936.

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

Industry	1929	1930	1931	1932
Paint	136,526	91,563	91,832	63,3[illegible]
Ceramics	4,246	3,366	2,848	1,7[illegible]
Other	6,259	7,211	2,688	1,5[illegible]
[illegible]	147,031	102,140	97,368	66,6[illegible]

Basic lead sulphate.—This pigment is [illegible] quantity so used in 1936 was 5 percen[illegible] percent below that in 1929. In 1929 [illegible] sulphate were used in storage batteries, b[illegible] Large quantities of this pigment are [illegible] increase the lead content. In 1936 a[illegible]

used for this purpose by pigment producers reporting to the Bureau of Mines. This tonnage is not included in the accompanying statement of sales of basic lead sulphate but is included in figures shown for leaded zinc oxide. It is the Bureau's policy to measure production of a plant in terms of final products.

Distribution of basic lead sulphate sales, 1929–36, by industries, in short tons

Industry	1929	1930	1931	1932	1933	1934	1935	1936
Paints	13,435	9,573	8,311	5,689	7,072	6,611	7,770	8,124
Rubber	655	394	173	77	161	93	155	126
Storage batteries	2,327	1,104	697	195	99	139		28
Other	397	456	505	296	613	224	374	144
	16,814	11,527	9,686	6,257	7,945	7,067	8,299	8,422

Litharge.—The principal use of litharge is in the manufacture of storage batteries, but this outlet has been affected adversely by the growing tendency of battery makers to substitute a black oxide or suboxide of lead, which they manufacture themselves. This practice was begun in 1923, and by 1929 a total of 33,000 tons of the black oxide was being made. In 1936 one battery maker began the manufacture of litharge. In all, 40,832 tons of oxides were made at battery plants in 1936 compared with 34,146 tons in 1935. None of this is included in the Bureau of Mines statement of litharge production.

Distribution of litharge sales, 1929–36, by industries, in short tons

Industry	1929	1930	1931	1932	1933	1934	1935	1936
Storage batteries	37,160	33,173	31,005	29,365	27,327	30,024	30,007	38,700
Insecticides	(1)	6,000	7,508	11,735	11,126	12,271	14,665	14,662
Chrome pigments	8,112	3,286	3,582	2,591	3,973	6,162	7,356	8,407
Ceramics	8,663	4,080	4,124	2,963	5,438	6,606	6,751	7,762
Oil refining	13,615	12,028	7,351	4,703	6,070	7,611	7,869	7,259
Varnish	3,124	698	641	1,360	610	414	564	2,307
Rubber	6,051	4,736	3,032	1,921	2,875	2,466	3,171	2,147
Linoleum	322	388	208	109	106	104	280	280
Other	10,269	8,180	5,839	3,199	3,668	2,982	3,207	4,722
	87,916	72,578	63,890	58,096	61,193	68,733	79,930	86,246

[1] Included under "Other." Not separately reported.

Red lead.—The use of red lead in storage batteries and paints in 1936 increased 15 and 35 percent, respectively, over 1935. The quantity used in paints nearly equalled the amount used in 1929.

Distribution of red lead sales, 1929–36, by industries, in short tons

Industry	1929	1930	1931	1932	1933	1934	1935	1936
Storage batteries	25,689	18,998	13,700	10,655	12,049	15,987	17,657	20,323
Paints	11,855	10,906	9,250	6,389	7,182	8,766	8,721	11,786
Ceramics	903	835	811	467	715	595	867	807
Other	4,574	2,202	2,086	1,369	1,142	1,395	1,531	1,980
	43,021	32,941	25,853	18,880	21,988	26,743	28,776	34,896

Orange mineral.—Sales of orange mineral decreased slightly in 1936. This pigment is used chiefly in the manufacture of inks and color pigments, and the tonnage involved is quite small.

Distribution of orange mineral sales, 1929–36, by

Industry	1929	1930	1931	193
Color pigments	487	188	114	1
Ink manufacture	151	88	119	
Other	40	80	49	
	678	356	282	2

Zinc oxide.—Total sales of zinc oxide we 1936 than in 1935. All uses shared in the inc ings and textiles, which remained virtually In the preparation of exterior paints, manufa proportions of zinc oxide than formerly. Of t was made by the French process and 58 p process, the same ratios as in 1935. The prop oxide made from scrap zinc was virtually the Over 3,000 tons of zinc oxide, not included herein, were used to make leaded zinc oxide included under leaded zinc oxide.

Distribution of zinc oxide sales, 1931–36, by i

Industry	1931	1932	
Rubber	47,072	37,679	5
Paints	31,357	22,369	2
Floor coverings and textiles	4,695	2,837	
Ceramics	3,171	1,782	
Other	8,605	7,583	
	95,700	72,250	9

Leaded zinc oxide.—This pigment is used manufacture of paint. The quantity sold was 36 percent more than in 1935. The pre lead content in exterior paints is reflected in of leaded zinc oxide in 1935 and 1936. Som marketing a 50-percent leaded zinc oxide. this heading includes approximately 2,400 t and over 3,000 tons of zinc oxide used by proc of leaded zinc oxide.

Distribution of leaded zinc oxide sales, 1931–36,

Industry	1931	1932	
Paints	18,292	14,072	
Rubber	38	26	
Other	247	207	
	18,577	14,305	

Lithopone.—Sales of lithopone to the pai the accompanying table, decreased slightly i latter years are not comparable to those for previously mentioned. Comparable figures

paint in 1936. The production of floor coverings and textiles rose appreciably in 1936. Of the total for that year approximately 6,800 tons were used in coated fabrics and textiles and the balance in linoleum and felt-base floor coverings. This distribution includes an estimate for one producer who was unable to segregate sales under these headings. Other items obtained in 1936 for which 1935 data are not available include paper, 1,629 tons, and ink, 321 tons. Lithopone production capacity was reported at 230,320 tons per year in both 1935 and 1936.

Lithopone is used extensively in interior paints, and in this field is now subject to intense competition from titanium pigments.

Distribution of lithopone sales, 1929–36, by industries, in short tons

Industry	1929	1930	1931	1932	1933	1934	1935	1936
Paints, etc.	150,804	126,076	119,446	93,465	106,995	114,472	124,615	122,461
Floor coverings and textiles	37,500	23,656	20,780	17,601	18,472	14,811	10,440	23,088
Rubber	7,176	5,997	5,833	3,958	5,078	4,596	4,435	4,908
Other	10,829	8,336	5,791	6,048	10,286	11,086	10,996	7,865
	206,315	164,065	151,850	121,067	140,831	145,565	159,486	158,319

Zinc sulphide.—Production of this pigment was reported by five plants in 1936; but owing to the fact that one producer represents such a large part of the total, the Bureau of Mines is unable to publish statistics. Most of the zinc sulphide is mixed with regular lithopone to make high-strength lithopone.

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

According to the Department of Agriculture, the consumption of zinc chloride by wood-treating plants totaled 2,050 tons in 1936. From a peak of 26,000 tons (solid basis) in 1921, consumption of zinc chloride in this field declined to 1,600 tons in 1934. The loss of this market is due primarily to the fact that zinc chloride is soluble in water and therefore is not as effective as creosote, its principal competitor, in preserving wood exposed to moisture. From time to time various insoluble zinc preservatives have been developed, but none has found a wide market. Recently a chromated zinc was introduced, but enough time has not elapsed to gage its effect on this market for zinc.

Complete data on sales of zinc chloride in 1936 are not available, but returns received from producers representing roughly two-thirds of the total output indicate the following distribution of sales by uses in 1936:

	Percent		Percent
Soldering flux	24	Oil refining	5
Wood preserving	23	Others	10
Dry-cell batteries	25		100
Vulcanized fiber	13		

Zinc sulphate.—In 1935 and 1936 producers of zinc sulphate were asked to distribute their sales according to various industries. The results of the canvass are not very satisfactory because the distribution was incomplete. Producers selling large tonnages to jobbers were unable to classify sales of this type by consuming industries.

Of the total 1936 sales (8,687 tons), 4,201
to the rayon industry, 331 tons to electr
glue manufacturers, 124 tons to printers an
tons to paint and varnish manufacturers; 3,5
A break-down of the latter figure would
larger tonnages for the various uses enum
of zinc sulphate were used as a flotation
collected by T. H. Miller of the Bureau of

RAW MATERIALS USED IN THE MANU ZINC PIGMENTS AND

Lead pigments and zinc pigments and s
a variety of materials, including ore, refin
secondary materials, such as scrap and w
processes. In 1936, 93.2 percent of the
derived from pig lead and 6.8 percent from
derived from secondary material. The pr
in 1936 were 63 percent from ore, 22 per
percent from secondary materials.

Metal content of lead and zinc pigments produ 1935–36, by sources, in s

Source	Lead pigmen
Domestic ore	12,
Metal	185,
Secondary material [2]	
	197,

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

In the following tables the source of the
ture of each pigment and salt is given.
either directly or indirectly, in the manufa
red lead, and orange mineral and to a larg
of basic lead sulphate. Zinc oxide is the
siderable slab zinc is used. Ore is empl
zinc oxide, leaded zinc oxide, lithopone, z
sulphate. Some secondary lead is used
lead sulphate, and a substantial proport
and zinc chloride made in the United Stat
material. There has been a large increase
zinc used in the manufacture of zinc oxid
has displaced slab zinc in the manufa
oxide.

Lead content of lead and zinc pigments produced by domestic manufacturers, 1935–36, by sources, in short tons

Pigment	1935				1936			
	Lead in pigments produced from—			Total lead in pigments	Lead in pigments produced from—			Total lead in pigments
	Domestic ore	Pig lead	Secondary material		Domestic ore	Pig lead	Secondary material	
White lead		83,079		83,079		89,779		89,779
Red lead		25,173		25,173		31,617		31,617
Litharge		74,724		74,724		81,883		81,883
Orange mineral		296		296		249		249
Basic lead sulphate	4,024	1,879		6,503	4,699	1,569		6,268
Leaded zinc oxide	7,484		144	7,628	10,363		37	10,400
Zinc oxide	[1]			[1]				
	12,109	185,151	144	197,404	15,062	204,997	37	220,096

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1935–36, by sources, in short tons

Pigment or salt	1935				1936			
	Zinc in pigments and salts produced from—			Total zinc in pigments and salts	Zinc in pigments and salts produced from—			Total zinc in pigments and salts
	Domestic ore	Slab zinc	Secondary material		Domestic ore	Slab zinc	Secondary material	
Zinc oxide	47,021	26,749	7,490	81,260	56,946	32,625	9,201	98,772
Leaded zinc oxide	16,185	104	356	16,645	19,065	138	183	19,386
Lithopone	[1] 20,600		13,512	[1] 34,112	18,902		13,450	32,352
Zinc sulphide	[2]			[2]	[2]		[2]	[2]
Zinc chloride	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]
Zinc sulphate	1,966		483	2,449	1,078		1,224	2,302

[1] Zinc content of a small quantity of zinc sulphide included with zinc content of lithopone.
[2] Figures not available.

PRICES

The total value and the average price received by producers from sales of lead and zinc pigments and salts are stated earlier in this chapter. The range of market quotations, as reported by the Oil, Paint, and Drug Reporter, appears in the following table. Quotations on lead pigments were advanced as the price of lead moved upward during the latter part of 1936. On October 1, zinc oxide prices were advanced by one-fourth cent per pound but were still considerably out of line with the price of the metal. A drop of 1 cent per pound in the price of titanium dioxide on November 2 was followed shortly by a reduction of one-fourth cent per pound in lithopone prices and 1½- to 2¼-cent cuts in zinc sulphide quotations.

Range of quotations on lead pigments and zinc p... (or delivered in the East), 1933–36, i...

Product	1933
Basic lead sulphate, or sublimed lead, less than carlots, barrels	6.50– 6.00
White lead, or basic lead carbonate, dry, carlots, barrels	6.00– 6.50
Litharge, commercial, powdered, barrels	5.50– 7.00
Red lead, dry, 95 percent or less, less than carlots, barrels	6.50– 8.00
Orange mineral, American, small lots, barrels:	
Ex-white lead	10.25–11.75
Ex-red lead	9.00–10.50
Zinc oxide:	
American process, lead-free, bags, car lots	5.75
American process, 5 to 35 percent lead, barrels, carlots	5.75
French process, red seal, bags, carlots	8.63
French process, green seal, bags, carlots	9.63
French process, white seal, barrels, carlots	10.88
Lithopone, domestic, 5-ton lots, bags	4.50
Zinc sulphide, less than carlots, bags, barrels	13.00–13.50
Zinc chloride, works:	
Solution, tanks	2.00– 3.00
Fused, drums	4.25– 5.75
Zinc sulphate, crystals, barrels	2.75– 3.75

FOREIGN TRADE

Imports of lead and zinc pigments and ... and exports increased 3 percent in 1936. T... from $452,000 to $572,000; in 1929 it was ... there was an apparent import surplus.

The following table shows the value of ... salts imported and exported for 1935–36.

Value of foreign trade of the United States in lea... 1935–36

	Impor...
Lead pigments:	
White lead	$1,...
Red lead	...
Litharge	...
Orange mineral	...
Other lead pigments	...
	2,...
Zinc pigments:	
Zinc oxide	205,...
Lithopone	256,...
Zinc sulphide	6,...
	468,...
Lead and zinc salts:	
Lead arsenate	...
Other lead compounds	36,...
Zinc chloride	34,...
Zinc sulphate	6,...
	76,...
Grand total	546,...

[1] Figures not available.

[2] Figures on imports and exports ...

Lead pigments and salts.—Imports of these commodities are of negligible proportions. The most important item is the group of lead compounds, including lead acetate, lead nitrate, and others.

Lead pigments and salts imported for consumption in the United States, 1932–36, in short tons

Year	Basic carbonate white lead	Red lead	Litharge	Orange mineral	Lead compounds	Total value
1932	29	4	----------	4	277	$52,865
1933	3	1	----------	10	208	39,312
1934	15	----------	(1)	5	183	29,368
1935	6	1	----------	2	302	[2] 38,228
1936	32	1	(1)	5	185	[2] 32,614

[1] Less than 1 ton.
[2] Includes also—1935: Lead pigments, n. s. p. f., $478 (4,405 pounds); 1936: Lead pigments, n. s. p. f. $19 (15 pounds) and sublimed lead (basic sulphate) $9 (15 pounds).

The principal exports are white lead, litharge, red lead, and lead arsenate. Less than 3 percent of the domestic production of white lead, red lead, and litharge was exported in 1936.

Lead pigments and salts exported from the United States, 1932–36, in short tons

Year	White lead	Red lead [1]	Litharge	Lead arsenate	Other lead compounds	Total value
1932	1,681	403	1,403	505	----------	$461,694
1933	1,048	570	1,538	209	----------	371,760
1934	1,561	745	972	325	----------	457,273
1935	2,337	750	1,280	578	----------	606,734
1936	1,861	810	1,386	414	----------	609,800

[1] Includes an unknown quantity of orange mineral, 1932–33.

White lead and red lead, orange mineral,[1] and litharge exported from the United States, by destinations, 1933–36, in short tons

Destination	White lead				Red lead, orange mineral,[1] and litharge			
	1933	1934	1935	1936	1933	1934	1935	1936
Countries:								
Argentina	60	60	98	126	109	232	162	139
Canada	75	91	50	74	1,104	415	502	344
Netherlands	377	463	827	387	----------	----------	2	43
Netherland West Indies	2	10	3	3	58	(2)	81	274
Panama	20	201	205	453	68	112	62	53
Philippine Islands	138	130	190	170	164	210	287	342
United Kingdom	73	47	93	13	17	3	2	17
Others	206	550	865	635	588	745	942	784
	1,047	1,561	2,337	1,861	2,108	1,717	2,030	2,196
Continents:								
North America	223	477	441	754	1,494	759	930	1,140
South America	150	177	202	218	210	348	402	344
Europe	479	590	1,242	707	213	232	139	219
Asia	141	(2)	285	172	201	40	335	407
Africa	53	167	166	9	80	118	224	62
Oceania	1	150	1	1	(2)	222	(2)	24

[1] Orange mineral is not included in this group in 1934–36. Data not available.
[2] Less than 1 ton.

Zinc pigments and salts.—Imports of l and were approximately twice as large amounted to less than 2 percent of domest

Zinc pigments and salts imported for consumptio in short tons

Year	Zinc oxide		Litho-pone
	Dry	In oil	
1932	2,515	157	4,724
1933	2,359	182	5,596
1934	1,204	64	3,927
1935	1,931	59	4,603
1936	693	96	4,780

Exports of zinc oxide and lithopone incre of this trade is with North American coun

Zinc pigments and salts exported from the Unite

Year	Zinc oxide	Litho-pone	Zinc salts	Total value	Yea
1932	1,261	3,212	299	$512,559	1935
1933	722	1,186	(1)	230,024	1936
1934	1,155	2,401	(1)	395,189	

[1] Zinc salts not separately recorded.

Zinc oxide and lithopone exported from the United in short tons

Destination	Zinc oxide		
	1933	1934	1935
Countries:			
Argentina	16	36	35
Canada	280	439	453
Cuba	22	87	115
France	5	12	15
United Kingdom	36	68	56
Others	357	513	466
	722	1,155	1,140
Continents:			
North America	437	856	724
South America	39	48	78
Europe	72	66	94
Asia	80	41	132
Africa	3	12	6
Oceania	91	132	107

THALLIUM

A bluish-white, soft metal, thallium (element 81) resembles lead not only in its physical properties but also, to a considerable extent, in its chemical properties, although in the latter respect it somewhat resembles potassium. The metal itself is obtainable without much difficulty, but it is used only in quite small amounts for special alloys; lead-thallium alloys are highly resistant to corrosion. Even in its compounds thallium finds no very large sale, although significant quantities, chiefly as sulphate, are used in rat poisons and for ground-squirrel and rodent control generally. It also has been recommended for killing ants and as a fungicide and insecticide. Small quantities, a few hundred pounds annually, have long been used in optical glass, photoelectric cells, and medicine, and later developments are moth-proofing agents and fabric-finishing materials. A variety of other uses, including antiknock motor fuel, have been suggested, many of them having been patented, but none of them seem to have reached the commercial stage. Formerly, thallium was used rather widely in depilatories, but inasmuch as it is a cumulative poison of high toxicity this use has been discouraged. Recently, however, experiments have been made in the U. S. S. R. (Russia) with a view to controlling the moulting of sheep, particularly of merinos that do not moult naturally; promising results were obtained, although many of the sheep died, and more work has to be done.

Thallium is not a common element, but it is present in a large number of minerals and moderately substantial quantities may be recovered from the flue dusts from lead furnaces and pyrites burners. Partly because the demand is rather small there is only one domestic producer, the American Smelting & Refining Co.; but additional quantities of thallium sulphate and a little thallium acetate have been imported from Germany, Poland, and Belgium. Prices since the World War have ranged from above $20 to a minimum of about $5 a pound. The price of the metal in small lots is $15 a pound.

THORIUM (AND MESOTHORIUM)

Thorium (element 90), like uranium, is the source of a series of radioactive elements of lower atomic weight. In the process of disintegrating to inert lead, the thorium group emits radiations similar to but not always identical with those from radium. Mesothorium, the immediate disintegration product of thorium, is chemically identical with radium. Its preparations emit the three types of rays characteristic of radium, but it is much shorter lived. Separated from thorium, a given specimen of mesothorium decays to half value in 6.7 years, to one-fourth of its original value in another 6.7 years, to only one-eighth of its original value in a third period of 6.7 years, and so on. The half-life period of radium, on the other hand, is 1,690 years. Mesothorium can be substituted for radium for certain therapeutic purposes but is possibly more important commercially in radioactive luminous materials. Over a period of 15 years, the brightness of luminous materials activated with mesothorium is in no way inferior to that of those made luminous by radium.[23] Formerly radium cost a great deal more than mesothorium, but as radium has

[23] Schlundt, Herman, Mesothorium: Foote-Prints, vol. 4, no. 1, 1931, pp. 3–17.

become cheaper, mesothorium, remai
is the more costly of the two. In 19
(522 Fifth Ave., New York, N. Y.) im
ium from Austria. Domestic requi
present more mesothorium is used ab
In England and France, for exampl
employed, activated with mesothoriu

The main use of thorium has been
which purpose thorium nitrate is extr
with a small amount of cerium. The
of "rare-earth nitrates", accompanie
nesium nitrate, and then burned.
the production of thorium nitrate,
Thorium compounds are used in X
have been employed for certain react
refractory and has been used recently
laboratory crucibles that can be emp
temperatures up to 2,300° C. Sint
the market by Westinghouse Lamp C
shapes and sizes at $75 a pound and
in filaments of tungsten lamps to
purpose, however, as well as for elec
electron-emitting uses, the element i
the metal. Suggested uses for the
glow-tube electrodes, and X-ray targ

Thorium is a soft, malleable meta
otherwise easily worked and handled
onic emissivity, consideration may be
the most refractory oxide known.
metal, but neither is it unduly costly
has fallen as a result of the diminish
industry for thorium nitrate. Thi
would seem to afford a sound basis f
of use.

Thorium nitrate has recently bee
Drug Reporter at $2.20 a pound. M
formerly quoted at $60 a ton basis 6
an 8-percent grade has been listed at
costs about $35 a milligram.

The imports of thorium nitrate a
1936 amounted to only 4,411 pounds
were 44,554 pounds valued at $89,67
pounds valued at $309,760 in 1914 (

TITAN

About two and a half times as plen
titanium (element 22) is a constitu
Ilmenite and rutile, however, are th
mined at all extensively as titanium
these minerals are relatively few.
British India, Norway, and the Un
worked, so that the supply is abund
has virtually no commercial uses, th
$6 a pound. Its alloys, particularly

used in the steel industry, are important and are consumed in rapidly growing quantities not only in steel making but also for use in making iron castings and various nonferrous alloys. Formerly employed almost exclusively as a deoxidizer, it has recently begun to be important in the manufacture of rustless steels to inhibit intergranular corrosion. Titanite, an aluminum-manganese-titanium alloy, takes a high polish that resists corrosion. Most important is the production of titanium pigments, which has grown at an astonishing rate in less than a decade from an insignificant industry requiring only 2,000 or 3,000 tons of ilmenite to a large business whose purchases of this raw material now exceed 100,000 tons a year. The consumption of rutile likewise has increased sharply. Scarcely 5 years ago this naturally occurring dioxide of titanium was used to only a small extent in the ceramic industry and had almost no other important applications until it began to be demanded in really large quantities for the manufacture of welding rods. Meanwhile, its ceramic uses have shown healthy growth. Titanium dioxide is used in ceramic glasses, in "topaz" yellow glassware, and to increase fluidity of acid-resisting enamels. For the acid-stable enamels as much as 8 percent TiO_2 is added, the yellow coloration being suppressed by a 2-percent addition of sodium fluosilicate.[24] A German patent (622346, I. G. Farbenindustrie) describes the production of a glass containing 20 to 48 percent of TiO_2 and 20 to 35 percent alkali (remainder acid oxides) made colorless by nitrate additions to the batch, which is melted slightly above 1,300° C.

Miscellaneous uses of titanium compounds are for smoke screens, "sky-writing", and pyrotechnics (tetrachloride); for arc-light electrodes; in dyeing and tanning; as abrasives (carbide); and in medicinal and toilet preparations. In addition to their use in paints and lacquers, titanium pigments are being used to an increasing extent in paper, linoleum, for delustering rayon, in printing ink, white rubber, plastics, cosmetics, soaps, and in shoe polishes and various leather and synthetic finishes.

Summarizing 1936 developments, E. L. Lasier, vice president of the Titanium Alloy Manufacturing Co., in a letter to the author, comments upon the greatly increased use of iron-titanium alloys (both high and medium carbon) in the steel industry for deep-stamping and automobile body stock. In the production of intermediate manganese steels, ferro-carbon-titanium is displacing more expensive alloys, notably nickel and vanadium. Other important developments have been the work on temper-hardening of copper-titanium alloys, the use of titanium in gray cast iron and in aluminum (through the use of a master alumino-titanium alloy), and a prospect of employing the element to assist in age-hardening of chrome-nickel steels.

The American Rutile Co., leading producer of rutile, formerly operated its milling plant at Roseland, Nelson County, Va., only 2 or 3 months at a time, but in 1935 it built a new, modern mill which was operated almost continuously in 1936 and may be enlarged to a capacity of 500 tons of crude ore a day. No production figures are released by the company, but private estimates place the present output as high as 2,000 short tons of rutile a year. Rutile or brookite was produced in Hot Springs County, Ark., in 1936 by the Titanium Corporation. It has been difficult to recover high-grade rutile in

[24] Vielhaber, Titanium Dioxide: Emaillwaren Ind., vol. 12, no. 52, 1935, pp. 419-420; Ceram. Abs., vol. 15, no. 8, 1936, p. 231.

commercial quantities from this a
Bureau of Mines succeeded in m
Arkansas rutile by flotation.

Ilmenite produced in this cou
mining by the American Rutile
the Southern Mineral Products
far from the Roseland operatio
1936 the latter company sold it
making calcium monophosphate
ginia Chemical Co., a newly cre
Printing Ink Co. The origina
mining activities and, in additio
concentrates to the new concern,
ferro-alloy works of the parent c
of America, at Niagara Falls, N.

Domestic production statistic
closing the operations of indivi
tistics serve to show the rapid gr
ilmenite and rutile. For several
imports of ilmenite and is still the
tributed 22,472 long tons in 19
rumors to the effect that the N
United States and accordingly
Europe. Of possible significance
in 1936 of $6.22 a long ton for i
$5.32 for those from British Ind
tons credited to the United King

Titanium ores imported for cons

Year	
1932	
1933	
1934	
1935	
1936	

Data on imports by customs
ilmenite is imported at New Y
divided between Maryland and
were entries at New Orleans for
ment ceased before 1936.

Rutile is now imported chiefly
were received in 1936 also fro
$1,128) and Australia (10,000
percent of the rutile arrives at N
except that in 1936 a fair-sized sh

Imports of ferrotitanium and
amounting in 1936 to 2,240 po
Kingdom.

Among foreign developments
at the Selianka mine in the Che
and a substantial increase of a

Straits Settlement containing only 0.15 percent tin and valuable chiefly for its titanium content. In Norway production has been increased so that around 60,000 tons annually can be handled, and a new aerial tram was built in 1936, according to a British report. At one time Ceylon produced monazite from its black-sand deposits, and recently the Ceylon Bureau of Industry and Commerce was reported to be giving attention to possible exploitation of these areas for ilmenite and zircon. The largest known black-sand deposit on the island is on the east coast about 35 miles north of Tricomalee and extends 4 miles along the shore. Brazil's rutile deposits are in the States of Goyaz and Minas Geraes. The ores from the latter State ordinarily contain ilmenite and, accordingly, analyze only 70 to 85 percent TiO_2, but those from Goyaz run up to 95 percent or more. In 1936 quotations f. o. b. Rio de Janeiro, for export to United States and England, were as low as $20 a metric ton. Ilmenite occurs in beach-sand deposits on the coast of Espiritu Santo, accompanied by monazite, zircon, garnet, and magnetite. The entire production of ilmenite in India comes from beach deposits leased from the Government of Travancore State. Until a few years ago two British firms, the Travancore Minerals Co., Ltd., and Hopkins & Williams, Ltd., were the only producers, but in 1932 F. X. Pereira & Sons entered the field, and, even more recently, M. E. Masillamany, B. A., Travancore, is rumored to have begun exporting, while a group called the Malabar Mining Co., Neyyattinkara, was said to be negotiating for a mining lease.

World production of titanium minerals, 1932–36, in metric tons

[Compiled by M. T. Latus]

Mineral and country	1932	1933	1934	1935	1936
Ilmenite:					
Australia: Tasmania		559			(1)
Canada (Quebec)			1,835	2,070	2,328
Egypt	487		164	183	(1)
French West Africa (Senegal)[2]		370	490	1,250	(1)
India, British (Travancore)	50,856	53,830	76,858	120,000	(1)
Malay States, Federated [2]	(1)	204	61	2,540	(1)
Norway	13,481	23,213	26,306	37,984	(1)
Portugal	766	645	434	264	(1)
United States	(3)	(3)	(3)	(3)	(3)
Rutile:					
Brazil [2]	35	96	116	287	(1)
Cameroun, French				45	(1)
Norway	[4] 30	[4] 56	247	[4] 124	(1)
United States	(3)	(3)	(3)	(3)	(3)

[1] Data not available.
[2] Exports.
[3] Bureau of Mines not at liberty to publish figures.
[4] Concentrates.

Ferro-carbon-titanium, the leading tonnage alloy, was quoted in 1936 at $137.50 per ton, f. o. b. Niagara Falls, N. Y., for the 7- to 8-percent-carbon product. Rutile concentrates, guaranteed minimum 94 percent, continued to be quoted at 10 cents a pound, although less than $100 a ton could be obtained for lower-grade ore that required further cleaning before it could be sold for ceramic uses. The price of artificially produced titanium dioxide of pigment grade was reduced from 17 to 16 cents a pound on November 4, 1936. This quotation is for carload lots and for packing in paper bags; for material packed in barrels the quotation is 16¼ cents.

URANIUM

According to most chemists, uranium element that is ever likely to be found neously decomposes to form at least tw ments (of progressively diminishing ato is the best-known and most important radium to uranium in pitchblende and o in 3.4 million, and unless the radium-be to have reached equilibrium, the propo that all radium-recovery operations re large quantity of uranium compounds. a surplus of such compounds, althoug also have been utilized mainly as a sou ment can be made without excessive d powder, but it has no recognized us advocated for use in making steel, and was employed in a small way as a subst ever, the consensus of opinion among to be that adding uranium to steel a cannot be obtained more economically acetate and other compounds are valu agents, and uranium salts have been photography, dye making, and medicin however, is in ceramic glazes and gla characteristic yellow colorization, for v (Na_2UO_4) is the usual commercial vehic or orange, contains 83 percent U_3O_8, and

The Vitro Manufacturing Co., Pitts Chemical Co., of Denver, Colo., produ country from domestic carnotite ore. domestic requirements, however, is sati sources. Imports of uranium oxide a until about 1926, rose to 272,913 pound and then, after declining during the 296,389 pounds valued at $292,207 i further to 341,040 pounds valued at $ Belgium, as in former years, althou $61,088 came from the newly created

VIRGINIU

The blank space in the periodic cha 87) was filled, it was announced, in 19 his coworkers at Alabama Polytechnic had discovered this long-sought subst analysis of pollucite and lepidolite. T The validity of this discovery was cha and Eugene Waiver, of Cornell Univers discovery of this element by X-ray analy doubt arose in the Cornell laboratories spectral lines exhibited by this cryst elusive element. In many minds, the as to whether element 87 has been d tainly tends to show that this element