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LEAD [1]

By A. L. Ransome and J. H. Schaum

SUMMARY OUTLINE

GENERAL SUMMARY

Lead, although an important member of the nonferrous metal group essential to the war program, did not show to advantage statistically during 1943 in comparison with the record-breaking levels attained by other major metals. Consumption of all lead increased slightly in 1943 owing to partial relaxation of Government conservation and limitation orders, but a marked decrease in refinery production and a decline in imports resulted in an excess of requirements over supply. Consequently the large stock of lead built up by the Government in 1942 from heavy foreign purchases—which reached a maximum by the end of March 1943—was drawn upon to make up the deficit. In recognition of the altered situation, the Conservation Division of the War Production Board reclassified lead on the Materials, Substitution and Supply List from group III (available as a substitute) back to group II (sufficient to meet war demands plus controlled essential industrial needs). The prospect for the duration of the war foretells a decreasing supply, which, however, will no doubt be adequate under continued control.

Refined primary lead production from domestic and foreign ores and base bullion decreased 21 percent in 1943; the total from both sources was 116,998 tons less than the 1942 output. Year-end stocks at domestic refineries (physical inventory) declined moderately, but consumers' inventories showed a 32-percent gain which reflects the receipts by consumers of enough foreign lead to raise stocks to a more normal working level.

Total imports of lead in all forms during 1943 declined 35 percent, largely in the category of refined lead, the principal source of which was Mexico. Receipts of lead in base bullion were markedly lower owing to the cessation of shipments from Australia.

The established price of 6.50 cents a pound for lead at New York remained unchanged throughout 1943.

[1] This report deals primarily with the smelting, refining, and consuming phases of the industry. For full details of mining operations, see separate reports issued for the various States.

Salient statistics of the lead industry in the United States, 1939–43, in short tons

	1925–29 (average)	1939	
Production of refined primary lead:			
From domestic ores and base bullion	660,525	420,967	
From foreign ores and base bullion	123,104	63,068	
	783,629	484,035	
Recovery of secondary lead	280,000	241,500	
Imports: [1]			
Lead in pigs, bars, and old	4,592	7,139	
Lead in base bullion	95,747	48,902	
Lead in ores and matte	40,096	30,842	
Exports of refined pig lead	98,048	74,392	
Lead remaining in bonded warehouse at end of period	136,969	79,215	
Refined primary lead apparently shipped to domestic consumers	690,916	415,031	
Estimated consumption of primary and secondary lead	900,250	667,000	
Prices:			
New York:			
Average for year...cents per pound	7.47	5.05	
Quotation at end of year...*do*	6.25	5.50	
London average...*do*	5.87	[3] 3.09	
Mine production of recoverable lead	664,230	413,979	
World smelter production of lead	1,850,000	1,911,000	

[1] Data include lead imported for immediate consumption plus mat
[2] Includes 25,324 tons of foreign refined lead reexported, according t
official figures not available.
[3] Includes 3,874 tons of foreign lead reexported in 1942 and 11,258 t
U. S. Department of Commerce.
[4] Data not available.
[5] Average for 8 months; London Metal Exchange dealings suspend
[6] Official maximum price fixed by British Ministry of Supply at £

Figure 1 shows trends in the domestic l

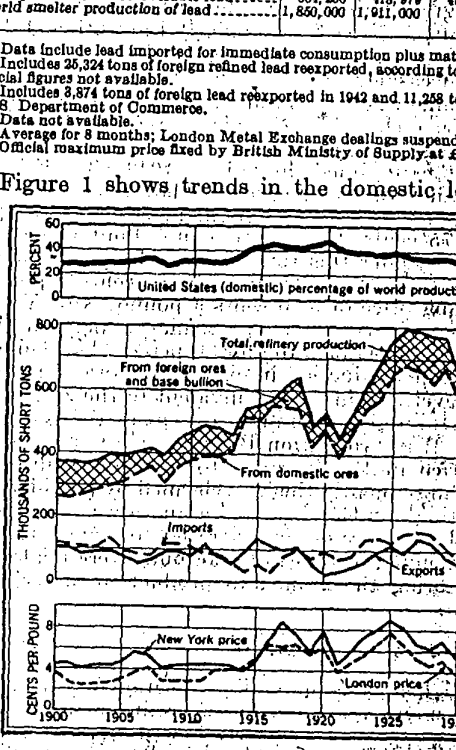

FIGURE 1.—Trends in the lead industry in the United States, 190
base bullion, pig lead, and scrap; exports include pigs, bars, and
with benefit of draw-back. Data on lead exported in manufactures
for 1943.

WAR AGENCY REGULATIONS

Lead remained under Government control throughout 1943, according to General Preference Order M-38, which provides for the regulation of shipments, deliveries, and a reserve pool for allocation. The original Order M-38, announced in October 1941 and later extended beyond the March (1942) termination date, included supplemental orders M-38-a through j; the last was revoked July 4, 1942. Since the beginning of 1943 four amendments to Order M-38 have been issued, dated January 1, February 2, May 26, and December 24, 1943; all have progressively liberalized the restrictions on the use of lead. Originally the uses of lead, under Conservation Order M-38-c, were divided into three classes—a prohibited list, an unlimited list, and all other uses to be limited in 1942 to 90 percent of consumption in the corresponding quarter of 1941. In the new Order M-38, as amended December 24, 1943, the list of prohibited uses has been retained with some changes, but the essential uses have been freed from all control.

Limitation Order L-180, affecting storage batteries, was amended January 5, 1943, to allow greater use of available antimonial lead and was again amended on January 22, 1944. Similarly Limitation Order L-64 was amended on March 16, 1944, to permit the use of more lead in the manufacture of caskets.

The premium-price plan, whereby producers (miners) of lead (copper and zinc were also included in the plan) receive additional increments above the ceiling price (through Metals Reserve Co.) for overquota production, was maintained throughout 1943. On February 18, 1943, the scope of the Metals Reserve Co. plan was broadened to include a B premium of 2.75 cents a pound in addition to the existing A premium of 2.75 cents, the effective time limit being extended to July 31, 1945. Under this revised plan the highest possible payment for excess production amounted to 12 cents a pound upon the basis of the ceiling price of 6.50 cents a pound, New York, depending on the quotas assigned to the particular mine. In the Tri-State district a premium of $41.80 a ton for 80-percent lead sulfide concentrates was payable for production in excess of quotas for each of the assigned A and B levels. This was equivalent to the 2.75-cent premium, allowing for metallurgical loss in treatment at the smelter. On October 27, 1943, the War Production Board issued a statement denying the premium price in the B range to mines not already operating on that date. Subsequently this was clarified by considering a mine as "already operating" on October 27 if a quota was assigned, the mine shipped metal (lead in ore or concentrates), or expenditures for development, reconditioning, or on capital account were made on or before October 27 to bring the mine into production under the benefits of the quota plan.

POST-WAR OUTLOOK

The United States has held a commanding position in the lead industry of the world for many years, both as a producer and a consumer. Owing to vast resources of relatively low grade ore—made available largely by creating a domestic price based upon a tariff—production from domestic sources supplied nearly the entire domestic demand for primary lead until the advent of the Second World War

late in 1939. The subsequent sharp
metal and lead in ore for pigments,
completely overshadowed production
balance of necessity had to come fr
largely in refined form from Mexico.
lead, for the most part held in Gove
made unnecessary any greater demand
particularly when all possible supply
the mining of more critical metals.
consumption, the incentive of premiu
increased output, and the expanded
generally kept supply and requirements
up consumer demand to be filled in the
will result in an annual consumption of
least 500,000 tons—probably more—fo
quantity needed for possible Governme
sidered and the lead recovered from se

The answers to the questions of the
and prices cannot be foretold. It is po
control to bridge the gap of industrial
peacetime economy and probable tha
The domestic mines could conceivably
for a limited time, given adequate price
reserves have been drawn upon heavily
past partial dependence on foreign le
increasing amounts as our resources are

DOMESTIC PROD

Pig lead is produced at primary plan
and small quantities of scrap and at s
scrap exclusively. Both types of plants
monial lead. Because of the large qu
battery scrap melted at secondary smelt
antimonial lead alloys. Figures for th
and alloys at secondary plants are given
Lead. The 16 smelters and refiners in
in 1943 consumed 500,197 short tons
percent of which originated in foreign co

REFINED LEA

Curtailed by labor shortages, scarci
imports of ore and base bullion the 10
only 471,475 tons of refined lead, 19 perc
579,695 tons.

Of the 449,841 tons of primary refin
percent was derived from domestic ores
cent from foreign. In 1942 the origin w
percent foreign. Virtually no refined lea
base bullion in 1943. The marked drop
Mexican base bullion being refined in M
ian material. Australian output was lo
copper and zinc production, and reduce

were directed to Great Britain. The following table gives the production of refined lead by country of origin of the ore. Details of the sources of lead from domestic ores are given in the section on Mine Production.

Refined lead produced at primary refineries in the United States, by sources, 1939–43, in short tons

Source	1939	1940	1941	1942	1943
Refined lead:					
From domestic ores and base bullion	420,967	433,065	470,517	467,367	401,071
From foreign ores	24,652	83,563	74,166	81,485	48,628
From foreign base bullion	38,416	16,551	26,284	17,987	142
Total from primary sources	484,035	533,179	570,967	566,839	449,841
From scrap	29,011	16,588	13,454	12,856	21,634
Total refined lead	513,046	549,767	584,421	579,695	471,475
Average sales price per pound	$0.047	$0.050	$0.057	$0.063	$0.064
Total calculated values of primary refined lead [1]	$45,499,000	$53,318,000	$65,090,000	$71,422,000	$60,349,000

[1] Excludes value of refined lead produced from scrap at primary refineries.

Refined primary lead produced in the United States, by country of origin, 1939–43, in short tons

Source	1939	1940	1941	1942	1943
Domestic ore and base bullion	420,967	433,065	470,517	467,367	401,071
Foreign ore:					
Australia	7,580	14,856	19,561	19,638	12,643
Canada	4,763	9,009	5,708	5,980	3,404
Europe	188	3,650	123	14	
Mexico	227	1,303	390	2,403	1,945
South America	8,869	34,744	27,173	23,127	7,294
Other foreign	3,025	20,001	21,211	30,323	23,342
	24,652	83,563	74,166	81,485	48,628
Foreign base bullion:					
Australia			831	16,902	
Mexico	37,463	16,161	25,358	111	57
South America	9		47	216	85
Other foreign	944	390	48	758	
	38,416	16,551	26,284	17,987	142
Total foreign	63,068	100,114	100,450	99,472	48,770
Grand total	484,035	533,179	570,967	566,839	449,841

ANTIMONIAL LEAD

Antimonial lead production at primary refineries increased 23 percent to 63,515 tons in 1943. The distribution of the lead, according to source, is shown in the following table. The antimony content continued to decrease, largely because of the increased quantity of low antimonial lead produced for bullet core rod. In addition to this antimonial lead produced as a byproduct in the refining of base bullion, a much larger quantity was obtained from the smelting of antimonial lead scrap at secondary smelters. Production data from lead-smelting plants handling scrap materials exclusively are summarized in the following section and discussed in detail in the chapter on Secondary Metals—Nonferrous.

Antimonial lead produced at primary lead refin

Year	Production (short tons)	Antimony content	
		Short tons	Percent
1939	21,995	2,031	9.2
1940	29,762	2,944	9.9
1941	40,237	3,510	8.7
1942	51,762	3,524	6.8
1943	63,515	3,371	5.3

SECONDARY LE

Although some scrap lead is treated part is received at a large number of es ondary materials exclusively. Seconda form of refined lead, antimonial lead, lead recovered in 1943 totaled 341,243 1942. The secondary refined-lead proc prised 11 percent of the total refined ou secondary recovered in antimonial lead total. Further detail appear in the ch Nonferrous.

Secondary lead recovered in the United S

As refined metal:	
At primary plants	
At other plants	
In antimonial lead:	
At primary plants	
At other plants	
In other alloys	
Grand total:	
Short tons	
Value	

LEAD PIGMENT

The principal lead pigments are lith sublimed lead, leaded zinc oxide, and o ucts are manufactured for the most pa Details of the production of lead pigm the chapter on Lead and Zinc Pigments

MINE PRODUCTI

The mine production of recoverable le lead pigments) in the United States and in 1943. Of the 23 States and Alaska States and Alaska showed a decline. T was due to several reasons, including e

reserves, manpower shortages, and inefficiency of available replacements for miners taken into the armed forces and those who left for higher-paying jobs in war plants.

Mine production of recoverable lead in the United States, 1925–29 (average) and 1939–43, by States, in short tons

State	1925–29 (average)	1939	1940	1941	1942	1943
Western States and Alaska:						
Alaska	982	937	779	662	415	200
Arizona	9,743	10,771	13,266	15,638	14,772	13,727
California	2,070	526	1,772	3,464	5,151	5,820
Colorado	30,112	8,222	11,476	12,574	15,181	18,032
Idaho	141,610	90,981	104,834	104,914	113,909	96,157
Montana	18,871	16,555	23,036	21,259	20,050	16,324
Nevada	9,807	4,236	7,499	9,623	5,376	4,790
New Mexico	6,730	5,392	3,822	4,668	4,608	5,723
Oregon	6	15	35	59	23	4
South Dakota	21		7		85	41
Texas	213	227	205	186	181	13
Utah	149,509	67,634	75,688	69,601	71,930	65,257
Washington	1,323	3,718	2,555	3,903	4,851	5,022
Wyoming					3	
	370,997	209,214	244,974	246,551	256,535	231,410
Central States:						
Arkansas	38		55	11	2	1
Illinois	552	308	1,508	2,376	2,344	2,043
Kansas	26,121	13,697	11,927	14,538	9,419	9,213
Kentucky	135	87	360	282	335	240
Missouri	202,240	156,281	172,052	165,909	199,548	184,910
Oklahoma	58,306	27,720	21,240	25,021	22,806	19,733
Wisconsin	1,745	388	445	1,225	775	920
	289,137	198,481	207,587	209,362	235,229	217,060
Eastern States:						
New York		2,387	1,973	2,100	2,434	2,355
Tennessee	250	517	573	23	238	200
Virginia	3,846	3,380	2,285	3,390	1,803	2,288
	4,096	6,284	4,831	5,513	4,475	4,843
	664,230	413,979	457,392	461,426	496,239	453,313

Lead mining is largely centered in three areas—Southeastern Missouri, the Tri-State area, and the Western States (principally Idaho, Utah, Colorado, Montana, and Arizona). The Eastern States supply only a minor proportion of the total. Although output of lead from Southeastern Missouri decreased 18,279 tons in 1943, this district continued to be the largest lead-producing area in the United States and supplied 39 percent of the total domestic production. The Tri-State area (Joplin region), the principal zinc-producing area in the United States, furnished 8 percent of the total United States output and contributed 381 tons more than in 1942 despite the severe floods late in May, which caused the temporary shut-down of many mines in that area. Idaho continued to be the leading producer among the Western States, notwithstanding a decline of 15 percent. Of Idaho's total lead output, the greater part came from zinc-lead ore and old tailings and the remainder largely from lead ore. Utah ranked second among the Western States and third in the United States in lead production, with an output of 65,257 tons of recoverable lead, which was 9 percent less than in 1942. Other principal producing States, in order of productivity, were Colorado, Montana, and Arizona.

Mine production of recoverable lead in the Un
1,000 tons or more during any year fro

District	State
Southeastern Missouri region	Missouri
Coeur d'Alene region	Idaho
Bingham	Utah
Joplin region	Kansas, Southwestern M souri, Oklahoma.
Park City region	Utah
Tintic	do.
Leadville	Colorado
Metaline	Washington
Warm Springs	Idaho
Central	New Mexico
Rush Valley	Utah
Harshaw	Arizona
Butte	Montana
Old Hat	Arizona
Ploche	Nevada
Resting Springs	California
Animas	Colorado
Pioneer (Rico)	do.
Coso	California
Smelter	Montana
St. Lawrence County	New York
Heddleston	Montana
Kentucky, Southern Illinois	Kentucky, Southern Illinoi
Upper San Migu	Colorado
Red Cliff	do.
Austinville	Virginia
Barker	Montana
Eagle	do.
Bayhorse	Idaho
Ophir	Utah
Wallapai	Arizona
Magdalena	New Mexico
Big Bug	Arizona
Upper Mississippi Valley	Iowa, Northern Illino Wisconsin.
Montana	Montana
Port Hill	Idaho
Cataract	Montana
Willow Creek	New Mexico
Hog Heaven	Montana
Oro Blanco	Arizona

[1] Total for Virginia but almost entirely from Austinville

STOCKS

Producers' stocks.—Lead stocks, as re
of Metal Statistics, are shown in the
fined and antimonial lead include meta
and by most refiners of secondary m
soft lead as well as foreign lead refined in

Lead stocks at end of year at smelters and refi
in short ton

	193
Refined pig lead	52
Antimonial lead	5
	58
Lead in base bullion—	
At smelters and refineries	10
In transit to refineries	3
In process at refineries	15
Lead in ore and matte and in process at smelters	29
	59
	118

for domestic consumption. Stocks of refined lead and antimonial lead fluctuated erratically from 34,937 tons at the beginning of the year to a high of 38,132 tons at the end of February, and a low of 20,438 tons at the end of June and closed 1943 with 27,996 tons on hand, a net decrease of 20 percent during the year.

The Bureau of Mines survey of primary smelters and refiners in 1943 asked for data on stocks at plants for the first time. The results of this survey showed stocks of refined lead amounting to 39,255 tons (lead content) at plants on January 1, 1943, and 36,464 tons on December 31, 1943. At these same plants primary antimonial lead stocks dropped from 4,631 tons (lead content) to 3,682 tons during 1943. In terms of lead content, stocks of ore at the 16 operating smelters and refineries increased 29 percent from 39,438 to 50,927 tons during the same period. The inventory of base bullion, at smelters only, totaled 6,323 tons at the beginning of January and 8,096 tons at the end of December. No direct correlation can be made between these data and the figures of the American Bureau of Metal Statistics. Figures reported to the Bureau of Mines represent physical inventory at the plants, irrespective of ownership, and do not include material in process or "in transit."

Consumers' stocks.—Approximately 430 consumer plants reported stocks of 108,012 tons of domestic and foreign refined lead on hand December 31, 1943, 32 percent greater than the 81,660-ton inventory held at the end of 1942.

Consumers' stocks of refined soft lead at the end of 1942 and 1943, by grades, in short tons

	Domestic and foreign					Foreign (all grades)
	Corroding	Chemical	Common	Other	Total	
Dec. 31, 1942 [1]	23,113	18,383	37,476	2,688	81,660	6,203
Dec. 31, 1943	23,921	18,706	60,873	4,512	108,012	12,706

[1] Revised figures.

Government stocks.—Industry-owned stocks were augmented by large quantities of lead bought by the Metals Reserve Co. (official Government purchasing agency) and stock-piled for emergency uses. According to reports submitted to the Tin-Lead Division of the War Production Board, Government stocks totaled 173,875 tons of refined lead and 3,267 tons of lead in ore and concentrates on December 31, 1943, compared with 248,361 tons of refined lead and no ore and concentrates held on January 1, 1943.

DOMESTIC CONSUMPTION

A survey of approximately 430 plants in 1943 representing 90 percent of the consumers of refined lead showed a total consumption of 675,465 short tons of refined lead, a gain of 11 percent over 1942. Secondary as well as primary refined lead is included in this figure. Antimonial lead, unrefined scrap lead, and lead in alloys are excluded. Of the total consumed, 18 percent was used to make red lead and litharge, 17 percent for cable covering, 10 percent for storage batteries, 10 percent for tetraethyl, 9 percent for ammunition, and the remaining 36 percent for a variety of products shown in the accompanying table.

Consumption of refined lead in the United Sta

Ammunition	
Bearing metals	
Brass and bronze	
Cable covering	
Calking lead	
Casting metals	
Collapsible tubes	
Foil	
Pipe, traps, and bends	
Sheet lead	
Solder	
Storage batteries	
Terne plate	
Type metals	
White lead	
Red lead and litharge	
Tetraethyl lead	
Chemicals and insecticides	
Annealing	
Galvanizing	
Lead plating	
Weights and ballast	
Other	
Total	

[1] Revised figures. [2] Included

A distribution by related uses shows 61 products, 25 percent for pigments, 11 and 3 percent in miscellaneous uses, su lead plating, weights, and ballast. Ow istics of the war, major gains were made tion, red lead and litharge, tetraethyl, increases for bearing metals, brass a solder, storage batteries, chemicals and

Reports to the Tin-Lead Division o indicate that the consumption of prima lead totaled 1,113,000 tons in 1943 con 1942.

The following table has been const

Apparent shipments of refined primary pig le in short tons

	1939
Supply:	
Stocks at primary refineries on Jan. 1	(1)
Government-owned stocks on Jan. 1 [2]	
Production	484,0
Imports	5,3
Total available	489,4
Withdrawn:	
Stocks at primary refineries on Dec. 31	(1)
Government-owned stocks on Dec. 31 [2]	
Exports	74,3
Total withdrawn	74,3
Apparent shipments to domestic consumers	415,0

[1] Official figures not available.
[2] Estimate based upon American Bureau of Metal Statistic
[3] According to reports submitted to the Tin-Lead Division
[4] Includes 25,324 tons of foreign refined lead reexported, acco official figures not available.
[5] Includes 3,874 tons of foreign refined lead reexported in 19 Department of Commerce.

shipments to domestic consumers by adding primary production, net changes in stocks, and excess of imports over exports. The apparent shipments of 757,890 tons are probably more nearly correct than the actual receipts of 701,817 tons reported by the consumer plants, because of incomplete coverage in the survey.

PRICES

The two major markets for lead in the United States are New York and St. Louis; much of the lead produced in this country is sold at prices normally based upon quotations in these markets. Since suspension of the London Metal Exchange dealings in September 1939 for the duration of the war the London market has had no actual influence on New York quotations, and the differential between St. Louis and New York prices has remained at 0.15 cent a pound, an amount approximating the freight charges between the two points.

The ceiling price for common lead—6.35 cents a pound, St. Louis, and 6.50 cents, New York—remained unchanged throughout 1943. For comparison it is interesting to note that the average price received by the primary producers for all grades of lead sold in 1943 was 6.4 cents a pound, f. o. b. plant (6.3 cents in 1942). The 1943 price of 7.5 cents for lead, which appears in the separate State chapters, represents the above weighted average price received for refined lead plus the increment—in terms of cents per pound based upon the total recoverable lead output—of $10,200,000 in overquota premiums paid by the Metals Reserve Co. A brief outline of the 1943 developments of the premium-price plan is given in this chapter under the heading, War Agency Regulations.

The official London maximum price of £25 per long ton, duty paid, for Empire and foreign lead, remained unchanged during 1943.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1941–43, in cents per pound [1]

Month	1941			1942			1943		
	St. Louis	New York	London	St. Louis	New York	London	St. Louis	New York	London
January	5.35	5.50		6.12	6.27		6.35	6.50	
February	5.45	5.60		6.35	6.50		6.35	6.50	
March	5.61	5.77		6.35	6.50		6.35	6.50	
April	5.70	5.85		6.35	6.50		6.35	6.50	
May	5.70	5.85		6.35	6.50		6.35	6.50	
June	5.70	5.85	(2)	6.35	6.50	(2)	6.35	6.50	(2)
July	5.70	5.85		6.35	6.50		6.35	6.50	
August	5.70	5.85		6.35	6.50		6.35	6.50	
September	5.70	5.85		6.35	6.50		6.35	6.50	
October	5.70	5.85		6.35	6.50		6.35	6.50	
November	5.70	5.85		6.35	6.50		6.35	6.50	
December	5.70	5.86		6.35	6.50		6.35	6.50	
Average	5.64	5.70	(2)	6.33	6.48	(2)	6.35	6.50	(2)

[1] St. Louis: Metal Statistics, 1944, p. 477. New York: Metal Statistics, 1944, p. 471.
[2] London Metal Exchange dealings suspended for duration of war. Official maximum price fixed by British Ministry of Supply at £25 in December 1939.

FOREIGN TRA

During 1943 imports of lead continue
extent of the record receipts of 1942.
pig lead imported in 1942 came from
Metals Reserve Co. contracts. The t
resulted in cessation of imports early ir
able from these countries. The signifi
total imports—the first break in the u
the resultant lowering of the available
necessary to meet requirements, with c
Government stocks of refined lead.
wartime program on imported lead is d
lowered imports to a large extent were
to group II of the Materials Substituti
group III position it held in 1942; whe
needs and as a substitute metal.

Imports.—Total imports of lead in 1
in 1942, l rgely because of a decline in i
to 34 percent. Receipts of lead in ore
22 percent of the total, were 12 percen
lead in base bullion were only about o
In the refined-lead category, Mexico
percent, Australia between 3 and 4 per
percent, compared with 52, 6, 23, and
1942. Nearly all imports of base bul
Australia (98 percent in 1942) during Ja
the entire amount remains in stock and
metal from this source. As in 1942, lea
numerous sources; the principal countr
Africa, and Newfoundland, which toge
the total imports of this material.

Total lead imported into the United States, 1939
short tons [1]

Year	Lead in ore and matte	Le
1939	30,842	
1940	111,300	
1941	82,115	
1942	79,362	
1943	70,023	

[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-foundla
1939	5,641	52,059	
1940	8,721	149,493	27,56
1941	95,686	129,446	17,66
1942	78,109	194,458	23,95
1943	8,337	217,294	13,47

[1] Data include lead imported for immediate consumption pl
[2] Includes imports from Argentina as follows—1938: 4 tons; 1
tons; and 1942: 4,532 *tons*. None reported in 1943.

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

Total lead imported into the United States in ore, matte, base bullion, pigs, bars, and old, 1939–43, by countries, in short tons [1]

Country	1939	1940	1941	1942	1943
In ore and matte:					
Africa	7	7,586	575	3,870	16,438
Argentina	3,362	16,469	13,374	4,582	
Australia	7,612	17,472	22,634	20,997	19,743
Bolivia	7	2,707	7,314	1,382	7,012
Canada	5,624	8,066	5,725	7,487	6,828
Chile	1,844	6,271	1,384	3,160	
Mexico	3,846	1,804	5,770	2,358	2,931
Newfoundland		27,563	17,569	23,951	13,473
Peru	7,174	18,383	6,665	11,168	3,436
United Kingdom [2]	1,058	3,498	175		
Other countries	308	881	930	392	172
	30,842	111,300	82,115	79,362	70,023
In base bullion:					
Australia			835	42,900	3,846
Mexico	47,915	19,009	23,726	56	639
Peru	84	179	58	16	94
Other countries	903	436	85	883	4
	48,902	19,624	24,704	43,855	4,583
In pigs, bars, and old:					
Australia	2,727	4,266	43,631	84,748	8,094
Canada	17	55	89,887	70,502	1,505
Mexico	298	128,680	99,950	192,044	213,724
Peru	4,051	18,452	40,868	21,948	20,158
Other countries	46	115	59	12	129
	7,139	151,568	274,395	369,254	244,510
	80,883	282,492	381,214	492,471	319,116

[1] Data include lead imported for immediate consumption plus material entering the country under bond.
[2] United Kingdom of Great Britain and Northern Ireland.

Lead [1] *imported for consumption in the United States, 1939–43, 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		
1939	12,317	$1,063,512	1,764	$166,298	4,772	$176,437	170	$28,296	$11,611	$1,449,541
1940	70,027	4,659,445	9,992	929,946	36,882	2,269,075	201	36,444	12,046	7,910,873
1941	82,345	5,343,577	17,579	1,743,350	325,999	23,403,260	47	15,812	19,389	30,582,741
1942	87,377	5,715,251	48,589	4,285,425	387,693	32,328,330	20	7,009	4,690	42,478,098
1943	82,212	5,467,211	4,511	557,545	244,033	20,900,607	25	20,208	5,219	27,006,948

[1] In addition to quantities shown (values included in total values), "reclaimed, scrap, etc.," imported as follows—1939: 26 tons, $3,387; 1940: 24 tons, $3,917; 1941: 1,331 tons, $57,353; 1942: 1,305 tons, $137,393; and 1943: 496 tons, $56,158. Figures for 1942 and 1943 include foreign lead received by the Government and held in stock piles.

Miscellaneous products, containing lead, imported for consumption in the United States, 1939–43

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
1939	136	45	$96,492	880	321	$38,491
1940	1,368	429	1,026,432	1,482	1,291	108,286
1941	702	241	711,388	1,657	1,464	112,120
1942	971	274	66,096	245	210	19,631
1943	236	69	330,824	3,703	3,422	447,019

Exports.—Under the restrictions of th
exports of pig lead in 1943 (excludin
lead) continued to be minor. Of the
was destined for the United Kingdom a

Lead exported from the Unit

Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)	
	Short tons	Value		
1939	74,392	$4,547,219	10,379	1942
1940	23,755	1,794,590	15,604	1943
1941	14,359	1,159,148	21,953	

[1] Data not available.

Pig lead exported from the United States, 19

Destination	193
Countries:	
Belgium	
Brazil	
Canada	
Chile	
China	
Denmark	1,
Finland	
France	
Germany	8,
Hungary	
Japan	34,
Kwantung	
Mexico	2,
Netherlands	2,
Norway	1,
Panama	
Philippine Islands	
Sweden	7,
United Kingdom [3]	9,
Uruguay	
Other countries	2,
	74,
Continents:	
North America	3,
South America	1,
Europe	33,
Asia	36,
Africa and Oceania	

[1] In addition, 25,324 tons of foreign lead were reexported, acc
official figures not available.
[2] In addition, 3,874 tons of foreign lead were reexported in
records of the Department of Commerce.
[3] United Kingdom of Great Britain and Northern Ireland.

WORLD ASPECTS OF THE

Although considerable information is
to wartime developments in lead, thes
confined to countries in the Western
dearth of pertinent information from
producing centers makes any estimates
sumption unwarranted. The last esti
indicated a world mine production of

LEAD AND ZINC PIGMENTS AND ZINC SALTS

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

SUMMARY OUTLINE

GENERAL SUMMARY

There was substantial improvement in sales of lead and zinc pigments as a whole in 1943, following the 1942 recession from the high rates for 1941, and operations were generally at satisfactory levels. As in 1942, by far the larger part of the orders was to supply Government requirements. Producers were again hampered by the restrictions on supplies of linseed and other drying oils and of slab zinc, and by the limitations on supplies of containers. Curtailment in the use of linseed oil, dehydrated castor oil, and oiticica oil was eased late in 1943 and early in 1944, but producers were still forced to make considerable changes in their manufacturing practices in order to accommodate their Government and civilian customers as nearly as possible. As the year progressed the problem of maintaining adequate experienced workmen in the producing industry became more acute, and early in 1944 the trade reported that anticipated gains in civilian requirements were threatened by an increasing shortage of journeyman painters.

The paint, varnish, and lacquer trade established a new high record for sales by a narrow margin in 1943, according to data of the United States Department of Commerce covering 680 establishments that accounted for approximately 90 percent of the value of the industry as reported in the Census of Manufactures for 1939. The value of sales in 1943 was $568,620,999 compared with $529,745,027 in 1942 and the previous record of $555,398,819 for 1941.

In the first half of the year pigments producers were again able to obtain pig lead more readily than slab zinc, and this factor tended to improve the competitive position of the lead group. As demands for zinc oxide rose, however, and calls for the French process grade increased, manufacturers were permitted enough slabs to fill their essential requirements. With regard to the metals themselves, the supply-requirements position for zinc showed noteworthy improve-

ment during the year, which led to rec
at the year end. Supplies of lead from
on the other hand, receded from the
and failed, by a substantial margin,
result, total inventories declined. The
largely to the stricter Government con
greater possibility of emergency war n
lead.

The production of titanium pigments
and in the peak year 1941, despite heavy
in 1943 than in 1942 but were below t
1941; they exceeded production in 1943,
reduced during the year. The situation
supplies reversed itself in 1943. In th
increased, and the restrictions on titan
December. In 1943, on the other han
creasingly critical, and Conservation
1943, again imposed limitations on the

The largest tonnage gain for pigment
in the quantity of zinc oxide used for
followed by the increase in the quantity
rubber manufacture. Litharge consu
ture also rose in 1943. Consumption of
manufacture was higher than ever before
also reached new heights in 1943 and th
to have been exceeded only in 1942.
the manufacture of paint, the largest
disappointing despite the increase in
previous peak for 1942 and the rise in
purpose. Sales of white lead to paint
below 1942 and were 32 percent less tha
5-year period, 1935–39. Sales of lithop
for this purpose also declined in 1943.
ceramics industry took pigments at the r

An outstanding event of the war peri
growth in the use of zinc yellow as a no
articles, published during the year, ma
said of this pigment "* * * In its co
zinc chromate stands as the most impo
* * *" Only one company covered
(those that use ore, metal, and scrap)
chromate as a final product. As other p
from zinc oxide, it would duplicate the q
in this report.

The development, on a substantial sc
paint finishes is worthy of note although
reported by only one company, figures f
be shown. The principal use of zinc
compositions to impart fire-retardant
netting and duck for military purposes.

On December 15, 1943, Simplified
R144–43, for paints, varnishes, and relate

[1] Callahan, John R., Modernizing Chemical Color Manufa
June 1943, pp. 106–111.
Chemical Industries, Paint Progress: Vol. 53, No. 5, Noven

Its purpose was to enable the industry to cooperate even more effectively in the war by further reducing the variety of colors. It had been accepted by a substantial percentage of the manufacturers and others concerned and was approved for promulgation by the United States Department of Commerce, through the National Bureau of Standards. The simplification program for limiting the variety of colors of paints, varnishes, and similar products to be manufactured and eliminating superfluous sizes of containers originally became effective in 1924, and the present revision is the fifth.

The container situation was recently described by Callahan.[2]

Three articles presenting several aspects of the paint situation were released in June 1943.[3]

Figures on pigments production in Canada indicate that on the whole 1942 marked a continuation of the advances noted in 1941 and that the industry operated at new record levels in that year; data for 1943 are not yet available. Zinc oxide and lithopone, however, dropped in 1942, leaded zinc and zinc leads making a particularly poor showing. The following statistics cover the quantities (in short tons) used in manufacturing in 1942 (1941 in parentheses): White lead (dry) 2,955 (2,164), white lead in oil 822 (714), basic sulfate white lead 74 (111), red lead 679 (648), litharge 809 (729), zinc oxide (pure) 1,211 (1,589), zinc oxide (leaded) and zinc leads 910 (2,255), lithopone

Salient statistics of the lead and zinc pigments industry of the United States, 1925–29 (average) and 1939–43

	1925–29 (average)	1939	1940	1941	1942	1943
Production (sales) of principal pigments:						
White lead (dry and in oil)..short tons	154,483	98,429	80,562	113,000	83,639	76,167
Litharge.....do	84,845	89,518	89,841	122,280	91,513	113,091
Red lead.....do	41,302	39,976	42,200	53,838	48,369	53,378
Zinc oxide.....do	164,208	114,552	113,213	148,833	99,677	143,402
Leaded zinc oxide..do	26,609	42,684	45,362	68,920	48,128	43,828
Lithopone.....do	177,745	142,759	161,802	176,642	137,320	135,723
Value of products:						
All lead pigments	$60,092,000	$35,485,000	$32,628,000	$46,572,000	$39,393,000	$41,897,000
All zinc pigments	41,314,000	28,794,000	28,747,000	39,210,000	30,785,000	36,260,000
Total	101,406,000	64,279,000	61,375,000	85,782,000	70,178,000	78,157,000
Value per ton received by producers:						
White lead (dry)	178	138	137	147	160	163
Litharge	176	123	126	134	150	152
Red lead	103	140	141	161	171	171
Zinc oxide	133	117	118	125	138	137
Lead zinc oxide	124	114	114	118	129	132
Lithopone	98	73	67	71	79	79
Foreign trade:						
Lead pigments:						
Value of exports	1,340,000	715,000	594,000	1,228,000	957,000	1,439,000
Value of imports	30,000	10,000	14,000	12,000	4,000	3,000
Zinc pigments:						
Value of exports	2,150,000	925,000	1,585,000	3,525,000	2,741,000	2,737,000
Value of imports	931,000	280,000	46,000	22,000	8,000	5,000
Export balance	2,635,000	1,350,000	2,119,000	4,719,000	3,686,000	4,168,000

[1] Callahan, T. Pat, What the War has Taught Us About Containers: Chem. Industries, vol. 53, No. 5, November 1943, pp. 666–667.

[2] Totten, Maj. A. I., Jr., Paint as a Material of War: Paint Industry Mag., vol. 58, No. 6, June 1943, pp. 190, 192, 194. Lutz, John A., Suggestions for Conserving Oils in Civilian Paint Products: Pp. 194, 196, 198. Aldrich, Lt. H. L., New Navy Paint Specifications: Pp. 198–199.

9,911 (10,538), titanium white (pure) 2,0
(reduced) 3,517 (2,948).

Late in 1943 the Zinc Pigment De
formed by the leading British producers o
purpose of the organization is to encour
and potential) of zinc pigments by all ap
by making their properties and applicat
appreciated.

POST-WAR PROS

The pigments industry will undoubte
markets that mark reconversion of indust
in the rehabilitation of the United States
An article by Trigg [4] on the return to
estimate of $16,070,000,000 per year of p
of the United States Department of Com
industry could have a $740,000,000 year
a 61-percent increase over 1940 total sal
poration estimated that total constructio
ing the war will average approximately
volume of the 1930–39 decade, which was
slow recovery. This would be an increas
prosperous 1920–29 decade, expressed
company stated. Trade estimates indica
ture after the war will average 50 perce
least until the pent-up demand has been s
indicated above and those in the rubber a
large pigment consumers point to a highe
tion in the post-war period. The gains
this report may not be distributed evenl
that all or virtually all will contribute to
war years lead pigments have had a rel
total market than zinc pigments, owing t
of pig lead than of zinc slabs available for

PRODUCTION

Sales in this report are taken as a bet
pigments industry than production beca
available on stocks and because materials
one item are sometimes sold under anoth
pigments produced under one classificatio
employed at a plant of another company
pigment in the lead and zinc group. The
to eliminate all possible duplication and t
the form in which they enter final use as
tities of basic lead sulfate and zinc oxide
leaded zinc oxide are omitted, except as
cation caused by other blending, which is
scale, is also avoided insofar as possible.
sumed by the producing companies, ho

[4] Trigg, Ernest T., Peace and the Painter: Paint Industry Ma
[5] Hillhouse, F. B., Paint and its Post-War Prospect: Domest
1943, pp. 14, 22–23.

beyond the ones covered by this report—that is, paint, storage batteries, and other articles—are considered as sales.

The total value of lead and zinc pigments in 1943 amounted to $78,157,000, a gain of 11 percent over 1942; except for 1941 it was the largest since 1929.

Lead pigments.—Red lead and litharge made the best showings of the pigments covered by this report, sales of red lead failing by a narrow margin to equal the peak rate for 1941 and those for litharge also being second only to those for 1941, dropping 8 per cent below that year. The poor record for white lead in recent years caused the lead pigments as a whole to fall below the zinc pigments in relation to the pre-war period, 1935–39. In 1943 the value of lead pigments was 29 percent higher than the average for the period 1935–39, compared with 35 percent for the zinc group. If white lead values were omitted from the totals, the gain in the lead pigments value for 1943 over the earlier period changes to 75 percent. The average values received by producers in 1943 showed slight gains, on the whole, over those for 1942. The advances were due to the somewhat higher prices that prevailed after the first month or two of 1942, which held throughout 1943. The average quotation for basic lead sulfate, on the other hand, was reduced in midyear 1942, and the revised quotation continued throughout 1943.

Lead pigments sold by domestic manufacturers in the United States, 1942–43

Pigment	1942			1943		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulfate or sublimed lead:						
White	7,229	$1,107,157	$153	4,752	$700,502	$147
Blue	1,181	191,811	162	845	126,102	149
Red lead	48,369	8,234,230	171	53,378	9,136,015	171
Orange mineral	128	30,643	230	79	19,736	250
Litharge	91,513	13,756,868	150	113,091	17,146,072	152
White lead:						
Dry	35,865	5,743,747	160	39,525	6,441,908	163
In oil [1]	47,774	10,308,863	216	36,642	8,326,458	227

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

Lead pigments sold by domestic manufacturers in the United States, 1939–43, in short tons

Year	White lead		Basic lead sulfate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1939	30,509	67,920	4,088	950	39,976	131	89,518
1940	30,116	50,447	5,493	707	42,200	137	89,841
1941	54,689	58,311	8,739	1,631	53,838	246	122,280
1942	35,865	47,774	7,229	1,181	48,369	128	91,513
1943	39,525	36,642	4,752	845	53,378	79	113,091

Zinc pigments and salts.—In the lead and zinc pigment groups zinc oxide had the largest tonnage and percentage gains in relation to 1942, surpassing the earlier year by 44 percent. In relation to other earlier

years, however, red lead and litharge m
Demands for zinc oxide gained rapidly d
ber it was placed under allocation, the
in more detail under Zinc Oxide. Lead
to decline from the 1941 peak record, bu
before 1940. Lithopone sales were virt
1942, having fallen 1 percent. The av
ducers for zinc oxide dropped $1.00 a
change in the price quotations for th
beginning of 1942 throughout 1943. Pr
after the first quarter of 1942, continu
the producers' average value to rise.
unchanged from the beginning of 1942
producers were identical.

Zinc pigments and salts sold by domestic manufac

Pigment or salt	1942	
	Short tons	Value (at pl clusive of co
		Total
Zinc oxide [1]	99,677	$13,746,599
Leaded zinc oxide [1]	48,128	6,209,558
Lithopone	137,320	10,828,924
Zinc chloride, 50° B	52,374	2,789,430
Zinc sulfate	14,331	1,179,281

[1] Zinc oxide containing 5 percent or more lead is classed as le
[2] Includes a small quantity containing less than 5 percent le

Zinc pigments and salts sold by domestic manufact
in short tons

Year	Zinc oxide	Leaded zinc oxide
1939	114,552	42,684
1940	113,213	45,362
1941	148,833	68,920
1942	99,677	48,128
1943	143,402	[2] 43,828

[1] Data not available.
[2] Includes a small quantity containing less than 5 percent lea

Sales of zinc chloride totaled 53,707
increase of nearly 3 percent over the
figures include the equivalent zinc chl
zinc chloride and zinc ammonium chlor
in 1943 were second only to those for 1
1942.

CONSUMPTION BY IN

White lead.—Total white lead sales (dr
percent below 1942; they were the sma
for 1933 and 1932 the smallest since 18
over 1942 and actually was larger than in
and 5 years in the 1920's. The decrea

therefore, was responsible for the poor showing for total white lead sales, both in relation to the record for 1942 and to that for many earlier years.

White lead is used mainly as a component of paint, 87 percent having been reported as sold for this purpose in 1943. A breakdown of the Other item would undoubtedly add to the paint classification.

Production of white lead totaled 61,129 tons.

Distribution of white lead (dry and in oil) sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Paint	92,380	73,137	100,665	76,837	66,441
Ceramics	1,767	3,029	3,704	1,812	1,444
Other	4,282	4,396	8,631	4,990	8,282
	98,429	80,562	113,000	83,630	76,167

Basic lead sulfate.—Basic lead sulfate also is consumed mainly in paints, either directly as a pigment or indirectly through its use as an intermediate product in the manufacture of leaded zinc oxide. The totals shown for basic lead sulfate exclude the product used in blending. In 1943, 5,600 tons were sold for use in the manufacture of leaded zinc oxide.

Production of basic lead sulfate totaled 7,121 tons in 1943.

Distribution of basic lead sulfate sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Paints	5,170	5,593	9,285	7,733	4,802
Rubber	140	128	200	89	131
Storage batteries	4	4	8		3
Other	224	475	877	588	661
	5,538	6,200	10,370	8,410	5,597

Red lead.—Sales of red lead failed by a narrow margin to equal the peak rate established in 1941. In virtually duplicating the 1941 rate it made the best showing of the pigments covered by this report. As in 1942 and 1941, the high rate of consumption of red lead is due to its application as a construction paint, its use for paints having reached new heights in 1943, but its use in storage batteries (the principal outlet) was below that in 1940 and 1941. In 1943, 42 percent of the red lead sold was for paint, whereas in the 5-year period 1935–39 only 30 percent was destined for this purpose.

Production of red lead amounted to 53,495 tons in 1943 or to almost precisely the quantity of sales.

Distribution of red lead sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Storage batteries	24,709	26,718	27,405	23,545	20,616
Paints	11,421	11,949	20,130	21,017	22,271
Ceramics	1,123	1,117	1,693	939	622
Other	2,723	2,416	4,710	2,868	3,869
	39,976	42,200	53,838	48,369	53,378

Orange mineral.—This is the smallest ite
the lead and zinc pigments canvass. Its pri
has been in the manufacture of ink. Sales
on record since statistics for this product we
in 1889.

Only 3 tons of orange mineral were report
in 1943.

Distribution of orange mineral sales, 1939–43, b

Industry	1939	1940
Ink manufacture	64	51
Color pigments	40	18
Other	27	68
	131	137

Litharge.—Sales of litharge in 1943 were 24
second only to the record for 1941, being 8
This favorable showing was surpassed only by
the pigments covered by this report. The q
batteries are well above double those for t
class, and in 1943 the quantity so used was g
ous year. In addition to the litharge used
storage-battery manufacturers themselves pr
of lead which they use as a substitute for li
tons of black oxide were produced, or only
record of 61,000 tons. These quantities rec
and 58,000 tons, respectively, of pig lead. Bl
included in the Bureau of Mines totals for l
tion of litharge for insecticides in 1942 was
amounts so used in several previous years.
passed the former peak record for 1941, b
ceramics, chrome pigments, oil refining, and
the previous year, but all except rubber we
Sales for chrome pigments manufacture gain
and those for rubber were up 24 percent and
Litharge sales to varnish makers were at a re
from 1942.

Production of litharge (112,037 tons in 19
by roughly 1,000 tons.

Distribution of litharge sales, 1939–43, by ind

Industry	1939	1940
Storage batteries	39,754	33,303
Insecticides	16,435	16,041
Ceramics	8,679	12,072
Chrome pigments	9,415	8,456
Oil refining	7,619	6,876
Rubber	1,404	1,690
Varnish	2,428	3,003
Linoleum	226	418
Other	3,559	3,082
	89,518	89,841

Zinc oxide.—This pigment made the largest gain in 1943 of any of the products covered by this report. The increase was partly a reaction from the severe drop in 1942, which had been dictated in part by stringent supplies of zinc metal and scrap and by the uncertainties in connection with the prospective consumption of zinc oxide by the synthetic rubber industry. The main part of the rise in zinc oxide sales was the quantity of pigment used for making smoke mixtures for chemical warfare. Consumption of zinc oxide in the manufacture of rubber—the largest use—increased 29 percent in 1943 and that in paints—second in importance—was 19 percent higher than in 1942. Floor coverings and textiles took 27 percent more zinc oxide in 1943 than in 1942, but the quantity so taken did not show up to advantage in comparison with several years before 1938. The ceramic industry's use of zinc oxide rose in 1943 against the trend for other pigments consumed for this purpose.

Zinc oxide makers were hampered in the first half of the year by their inability to obtain adequate supplies of slab zinc for the manufacture of French-process grades. As the year progressed, however, and demands for zinc oxide increased, the War Production Board released all required metal to the producers.

Production of lead-free zinc oxide amounted to only 123,913 tons, or over 19,000 below sales. Of the total, 101,898 tons were produced by the American process almost entirely from ores or primary residues, 17,844 tons by the French process from metal or scrap, and 4,171 tons by other processes—largely from scrap materials.

On September 13, General Preference Order M–11–A was amended to prevent producers of lead-free zinc oxide from shipping any of their product not previously set aside, as ordered, except (1) to fill orders rated AA–5 or higher, (2) to a person certifying that his stocks and supplies from all sources would be less than 1 ton, or (3) except as otherwise specifically authorized in writing by the War Production Board. On December 29 lead-free zinc oxide was placed under allocation control in a rewriting of Order M–11–A, which listed 26 permitted uses. Deliveries of 2 tons or less could be accepted, under provisions of the order, without obtaining specific authorization of the Board, but only for the uses listed in the revised order.

Distribution of zinc oxide sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Rubber	70,187	70,979	90,429	52,717	67,898
Paints	25,334	23,268	30,304	25,122	29,852
Chemical warfare					21,801
Floor coverings and textiles	5,641	4,752	6,991	5,224	6,633
Ceramics	6,572	6,352	8,596	2,934	3,203
Other	6,818	7,862	12,513	13,680	14,015
	114,552	113,213	148,833	99,677	143,402

Leaded zinc oxide.—Sales of leaded zinc oxide declined 9 percent in 1943 following the more severe drop of 30 percent in 1942 from the peak rate for 1941. Despite the decreases mentioned, leaded zinc oxide sales for 1943 had not been exceeded before 1940. It is used almost exclusively in the manufacture of paint. The figures for

leaded zinc oxide include basic lead sul
cated under Basic Lead Sulfate.

Leaded zinc oxide sales in 1943 were
tion of 39,515 tons. Of the output, 19,
percent lead, 16,611 tons 35–50 percen
more than 50 percent.

Distribution of leaded zinc oxide sales, 1939

Industry	1939	
Paints	41,519	
Rubber	1	
Other	1,164	
	42,684	

Lithopone.—The lithopone statistics i
the basis of ordinary lithopone sold as su
content of the high-strength product.
used to conceal the operations of one c
nates the output of the high-strength
ducer in some years. Three plants and
in high-strength lithopone production
change in the rate of sales of lithopone in
however, were 33 and 34 percent, respec
in 1929. By far the largest part of sales
facture of paints, 77 percent of the total
in 1943 and 80 percent in 1942. Sales
compared with 1 percent for total sales.
take the second largest amounts, but t
percent of the totals for the 2 years.
1943 but was 14 percent lower than
period ended 1941. Based upon somev
separation of the 1943 quantities show
floor coverings and textiles indicates th
linoleum and felt-base floor coverings a
fabrics and textiles (oilcloth, shade c
similar products). Other sales in 1943
and 1,137 tons (incomplete) for printing i
in 1943 and ink 105 percent. Figures
printing ink cannot be separated from
principal item under Other uses covers
least, has classified part of its exports
that the Other class is too small to cove

Plant capacity for the production o
total 157,000 tons, a drop from 182,0
drop is explained chiefly by the closin
the plant of the United Color & Pigmen
company reported that the plant was be

Production of lithopone totaled 132,62

Distribution of lithopone sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Paints, etc.	113,995	[1] 117,075	[1] 132,601	[1] 109,216	[1] 103,860
Floor coverings and textiles	17,429	18,738	21,114	15,775	15,999
Rubber	3,189	3,387	3,547	1,047	1,078
Other	8,146	12,602	19,290	11,282	14,786
	142,759	151,802	176,642	137,320	135,723

[1] Includes a quantity, not separable, used for printing ink.

The consumption of ordinary-strength lithopone in the manufacture of titanated lithopone (which usually contains about 15 percent TiO_2) amounted to only 8,400 tons in 1943 or to considerably less than half of the record tonnage of 19,400 tons for 1937. This use of lithopone has trended downward almost continuously since the peak was reached. Lower production by the United Color & Pigment Co., mentioned in the preceding paragraph, was chiefly responsible for the drop in 1943. The lithopone figures in the following table are included in the totals for ordinary lithopone in the preceding table.

Titanated lithopone produced in the United States and ordinary lithopone used in its manufacture, 1939–43, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year	Titanated lithopone produced	Ordinary lithopone used
1939	16,100	13,700	1942	[1] 11,700	9,900
1940	18,100	15,200	1943	9,800	8,400
1941	16,800	14,100			

Zinc sulfide.—Only one company produced zinc sulfide in 1943 and in 1942, therefore it is not possible to publish totals for this product.

Zinc chloride.—Sales of zinc chloride, in terms of 50° B. solution, totaled 53,707 tons in 1943 compared with 52,374 tons in 1942—a gain of 3 percent. These figures include the zinc chloride equivalent of zinc ammonium chloride and of chromated zinc chloride produced. Comparable data for recent earlier years and complete figures showing distribution of sales by uses are not available.

Zinc sulfate.—Sales of zinc sulfate gained 9 percent in 1943 and were second only to those for 1941, being 18 percent below that record total, however. Rayon resumed its place as the leading use in 1943, having been supplanted by agriculture in 1942 and by chemicals in 1941. A further break-down of the chemical classification, however, probably would add tonnage to several of the groups. Rayon sales increased 44 percent in 1943 and have been exceeded only by those in 1941. The agricultural use has been taking increasing quantities of zinc sulfate, reaching a peak in 1942 from which it dropped 19 percent in 1943. The feature of sales in 1943 was the gain in the quantity for paint and varnish processing. This class gained 27 percent in 1943 to its second successive peak and represented 16 percent of total sales; in 1936 and 1937 it accounted for only 1 and 2 percent, respectively. The chemical class dropped 37

percent in 1943, following a severe decline i
probably indicate that a more precise break
mation has been possible.

Distribution of zinc sulfate sales, 1939–43, by i

Industry	1939	1940
Rayon	3,897	3,649
Agriculture	2,168	2,366
Paints and varnish processing	583	1,509
Chemicals	1,309	2,151
Flotation reagent	260	241
Glue	172	320
Textile dyeing and printing		54
Electrogalvanizing	556	348
Other	1,206	1,299
	10,157	11,937

RAW MATERIALS USED IN MANUFACTUR
PIGMENTS AND ZINC S

The schedules for compiling statistics on
zinc pigments and salts in 1943 were change
years to obtain more precise information re
materials used and more data on end produ
the figures ordinarily presented in this secti
and zinc pigments will be no longer availabl
Figures covering lead and zinc in ore and
making total pigments should be available l
be released to the public at that time.

PRICES

The total and average values reported by
zinc pigments are given in the tables in the
Except for basic lead sulfate, average values
were either the same as in 1942 (as in the case
$2 to $11 a ton. In the main, the gains wer
in prices for lead pigments during the first
which quotations were unchanged throughc
year and through all of 1943. The rise in
came later in 1942 than the others. The w
sulfate was quoted at 7¾ cents a pound for
did not go above 7½ cents in 1943; the avera
declined in 1943, contrary to the record for

Prices for pig lead were unchanged throu
established by the Office of Price Administ
in January 1942. The ceiling price for com
York, was 6.50 cents a pound. Corroding
allowed premiums of 0.10 cent a pound.
ever, was quoted throughout 1943 at 0.05 ce
at New York and at St. Louis. Ordinarily
closely the price movements in pig lead.

Except for the grades of zinc oxide containing 35 percent or more lead, there were no changes in zinc pigment quotations from the first of 1942 throughout 1943. Leaded zinc oxide values received by producers gained an average of $3 a ton in 1943, whereas the lead-free grade dropped $1 and lithopone was unchanged.

As a rule the relationship between zinc pigment quotations and those for slab zinc are not as close as that among the lead classes. This situation is due largely to the fact that much ore is used directly in the manufacture of zinc pigments, whereas pig lead is the source of most of the lead pigments produced.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1940–43, in cents per pound

Product	1940	1941	1942	1943
Basic lead sulfate, or sublimed lead, less than carlots, barrels	6.25– 6.75	6.50– 7.00	7.00– 7.75	7.50– 7.75
White lead, or basic lead carbonate, dry, carlots, barrels	7.00– 7.50	7.50	7.50– 8.25	8.25
Litharge, commercial, powdered, barrels	6.25– 8.25	7.00– 8.25	7.35– 9.00	8.00– 9.00
Red lead, dry, 95 percent or less, less than carlots, barrels	7.75– 9.25	8.50– 9.25	8.75–10.00	9.50–10.00
Orange mineral, American, small lots, barrels	10.25–11.75	11.00–11.75	11.25–12.50	12.00–12.50
Zinc oxide:				
American process, lead-free, bags, carlots	6.25– 7.50	6.50	7.25	7.25
American process, 5 to 35 percent lead, barrels, carlots	6.25– 6.75	6.25– 6.75	7.00– 7.38	7.25– 7.38
French process, red seal, bags, carlots	7.50– 7.75	7.75	8.50	8.50
French process, green seal, bags, carlots	8.00– 8.25	8.25	9.00	9.00
French process, white seal, barrels, carlots	8.75– 9.00	9.00	9.75	9.75
Lithopone, ordinary, small lots, bags	3.85– 4.00	4.10	4.60	4.60
Zinc sulfide, less than carlots, bags, barrels	7.75– 8.00	8.00– 8.25	8.50– 8.75	8.50– 8.75
Zinc chloride, works:				
Solution, tanks	2.25	2.25– 2.50	2.50	2.50
Fused, drums	4.25– 5.75	4.25– 6.50	5.00– 6.50	5.00– 6.50
Zinc sulfate, crystals, barrels	2.90– 3.90	3.15– 4.40	3.65– 4.60	3.85– 4.60

FOREIGN TRADE [6]

As usual, all of the important items in foreign trade in lead and zinc pigments and salts were in the export classification in 1943. The chief value in imports covered zinc sulfate, and its value represented well over half of the import total. Even for this item the balance was strongly in favor of exports, and all other items covered showed export excesses. Lithopone, as usual, was the chief export class in point of tonnage in 1943, and it was followed by zinc oxide, white lead, litharge, and red lead. The exports of no item other than lithopone represented as much as 10 percent of domestic sales and of only white lead as much as 5 percent of domestic sales. Except for the items specified, foreign trade in lead and zinc pigments and zinc salts has little significance. The total value of lead pigments exported rose 50 percent in 1943, but that for the zinc group was relatively unchanged. Value of the two classes plus that for lead and zinc salts gained 19 percent in 1943.

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

Value of foreign trade of the United States 1942–43

	Import
Lead pigments:	
White lead	
Red lead	$
Litharge	
Orange mineral	
Other lead pigments	3,
	3,
Zinc pigments:	
Zinc oxide	6,
Lithopone	
Zinc sulfide	1,
	7,
Lead and zinc salts:	
Lead arsenate	
Other lead compounds	2,
Zinc chloride	
Zinc sulfate	18,
Other zinc salts and compounds	(1)
	20,
Grand total	32,

[1] Data not available.

Lead pigments and salts imported for consum

Year	S	
	Basic carbonate white lead	Red lead
1939	11	2
1940	2	
1941	2	3
1942		2
1943		4

[1] Includes also—1939: Lead pigments, n. s. p. f., $690 ($6,620 (40,445 pounds); 1940–43: Suboxide of lead, n. s. 1941: $11,694 (65,268 pounds); 1942: $3,221 (13,228 pounds);
[2] Less than 1 ton.

Lead pigments and salts exported fro

Year	Short to			
	White lead	Red lead	Litharge	
1939	2,024	1,324	2,077	
1940	1,360	1,336	1,586	
1941	2,901	2,966	2,892	
1942	2,249	1,391	1,999	
1943	4,692	1,535	1,610	

[1] Not compiled on an annual basis before 1942.

Zinc pigments and salts imported for consumption in the United States, 1939–43

Year	Short tons						Total value
	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	
	Dry	In oil					
1939	1,485	66	2,641	7	300	325	$317,719
1940	273	45		(1)	19	245	54,923
1941	122	11	(1)	1		16	29,835
1942	13	1		1		362	26,300
1943	10	11				546	34,033

[1] Less than 1 ton.

Zinc pigments and salts [1] exported from the United States, 1939–43

Year	Short tons		Total value	Year	Short tons		Total value
	Zinc oxide	Lithopone			Zinc oxide	Lithopone	
1939	3,485	4,845	$925,468	1942	6,013	17,036	[2] $2,913,595
1940	3,239	14,298	1,584,667	1943	6,019	17,320	[2] 2,898,253
1941	8,264	21,527	3,525,386				

[1] Zinc salts not separately recorded on an annual basis before 1942.
[2] Includes also—1942: Zinc sulfide $6,328 (37,691 pounds); zinc chloride, $42,674 (648,343 pounds); zinc sulfate, $53,624 (1,025,554 pounds); other zinc salts and compounds, $76,023 (519,458 pounds); 1943: Zinc sulfide, $29,523 (78,387 pounds); zinc chloride $57,390 (751,861 pounds); zinc sulfate $81,750 (1,830,508 pounds); other zinc salts and compounds, $22,087 (139,940 pounds).

GOLD, SILVER, COPPER,

(MINE RE

By CHAS. W. HENDERSO

SUMMARY

SUMM

The production of gold in Alask
The gold recovered from ores and
ounces valued at $3,485,405, a dec
production and the lowest quantity
The value of the gold in 1943 was
of the gold, silver, copper, and lea
for this marked decrease in gold
Board Gold Mining Limitation Or
full effect of which was not felt in
47 available floating connected-bu
during the year. These dredges w
reprieves granted with the provision
not qualified for any type of war v
dredge was in operation in 1943; n
was disposed of to contractors o
Out of the 38 lode mines in operat
1943, but these 8 mines supplied 58
of the silver produced in the Ter
Mining Co. at Juneau was by far th

One other important reason for t
Alaska in 1943 was the serious shor
by the high wages offered laborers
construction projects throughout th
of the mining in 1943 was carried on
could not work in essential war acti

The regulations on gold mining
Production Board during 1943 to
placer gold-mine operators in th
Limitation Order L–208, as origin
closed down all "nonessential" mi
produced 1,200 tons or less of com
rate of production of such mines di

WORLD PRODUCTION

Because of restriction on the publication of statistics by certain governments, figures for many countries have not been available since 1939.

World production of platinum and allied metals, 1937–43, in troy ounces

[Compiled by B. B. Waldbauer]

Country and product	1937	1938	1939	1940	1941	1942	1943
Australia:							
New South Wales: Placer platinum	46	8	(1)	(1)	(1)	(1)	(1)
Tasmania: Placer osmiridium	586	191	283	(1)	(1)	(1)	(1)
Belgian Congo: From refineries:							
Palladium	12,507	1,575	3,312	(1)	(1)	(1)	(1)
Platinum	2,122	226	868	(1)	(1)	(1)	(1)
Canada:							
Placer platinum	22	16	25	24	60	30	(1)
From refineries: [2]							
Platinum	139,355	161,310	148,877	108,464	124,257	298,400	(1)
Other platinum metals	119,829	130,893	135,402	91,522	97,432	226,600	(1)
Colombia: Placer platinum (exports)	29,315	34,549	39,070	35,859	37,349	49,163	39,961
Ethiopia: Placer platinum	3,376	3,537	(1)	(1)	(1)	(1)	(1)
Italy: From refineries: Platinum	1,286	1,029	(1)	(1)	(1)	(1)	(1)
Japan: Placer platinum	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Netherlands Indies (probably placer platinum)		21	28	34	(1)	(1)	(1)
New Zealand: Placer platinum	55	1	13		35	21	(1)
Panama: Placer platinum	267				(1)	(1)	(1)
Papua: [3]							
Placer platinum	20	41	2	(1)	(1)	(1)	(1)
Placer osmiridium	8	4	4	(1)	(1)	(1)	(1)
Sierra Leone: Placer platinum	308	180	83	135	(1)	(1)	(1)
Union of South Africa:							
Platinum (content of platinum metals) [4]	17,776	18,256	18,068	20,140	16,580	20,950	[5] 13,328
Concentrates (content of platinum metals) [4]	21,849	35,124	41,243	51,835	69,150	53,160	[5] 36,033
Osmiridium [4]	5,790	5,354	7,031	(1)	(1)	(1)	(1)
U. S. S. R.: Placer platinum [6]	100,000	100,000	100,000	100,000	100,000	100,000	100,000
United States:							
Placer platinum	10,803	40,932	32,460	33,800	26,221	23,213	[5] 27,162
Ore (content of platinum metals)	124	90	66		15	26	
From refineries: [7]							
Platinum	4,761	3,761	5,270	4,470	1,805	4,333	5,205
Other platinum metals	5,817	3,486	3,364	3,304	4,689	5,472	5,185
Total [8]	476,000	541,000	540,000	465,000	483,000	790,000	(1)

[1] Data not available.
[2] Recovered from nickel-copper mattes.
[3] Year ended June 30 of year stated.
[4] Produced from platinum ores.
[5] January to September, inclusive.
[6] Produced from treatment of gold ores on the Rand.
[7] Estimate.
[8] Subject to revision.
[9] New platinum metals recovered in gold and copper refining of domestic materials.

Canada.—Although the Bureau of Mines is not at liberty to publish figures on the recovery of platinum metals from the nickel-copper ores of the Sudbury district, Ontario, in 1943, it can be stated that the output was substantially less than the all-time high in 1942, which was 298,400 ounces of platinum and 226,600 ounces of other platinum-group metals.

Colombia.—Colombia exported 39,961 ounces of crude platinum in 1943 (49,163 in 1942). The South American Gold & Platinum Co. produced 23,945 ounces of crude platinum metals in 1943 (25,786 in 1942) and 55,446 ounces of gold (51,974 in 1942). The figures for other operators are not available.

TITANIU

By ALLAN F. M

SUMMARY OU

GENERAL STAT

Development of titanium mining United States during 1943 nearly tri fully two-thirds of the domestic ilmeni the rutile. Imports of ilmenite did no gap, so stocks were reduced one-fourth hand, were ample to maintain stocks consumption. Titanium prices were u

Post-war demand is expected to be principally because titanium provides partly because it is the most abunda standard requirement of the expande United States probably will achieve sel the latter half of 1944. Largely respo New York ilmenite mine, which is ex after the war, although possibly at a re more economical to import ore from In

Creation of a titanium pigment cart British, Italian, Japanese, and other f the Antitrust Act was charged by th Federal grand jury indictment in Ne and before the War Mobilization Su Affairs Committee, November 4. E. I Inc., the National Lead Co., and seve with division of the world market int national patent transfers to avoid seizur prices, and monopolistic control of the Replying to the charges, Fletcher W National Lead Co., stated that they sidered legal and proper at the time th the Government to formulate a policy business.

DOMESTIC PRODUCTION

Ilmenite production in the United States nearly tripled in 1943 compared with 1942, and rutile output increased 51 percent. Ilmenite concentrates shipped in 1943 contained 44 to 60 percent TiO_2, and rutile concentrates ranged from 90 to 94 percent TiO_2.

Production and mine shipments of titanium concentrates from domestic ores in the United States, 1939–43

Year	Ilmenite				Rutile			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Gross weight (short tons)	TiO_2 content (short tons)	Value		Gross weight (short tons)	TiO_2 content (short tons)	Value
1939	14,602	16,872	7,668	$137,042	(1)	(1)	(1)	(1)
1940	20,608	20,702	9,505	183,686	2,888	2,057	2,475	$303,243
1941	23,297	21,526	9,930	196,522	3,130	3,431	3,192	493,782
1942	77,208	93,397	41,328	1,805,823	2,648	2,049	2,466	410,956
1943	203,561	211,715	94,283	3,738,970	3,987	3,941	3,639	610,879

(1) Bureau of Mines not at liberty to publish figures.

Arkansas.—The Titanium Alloy Co. of Arkansas, Inc., subsidiary of Titanium Alloy Manufacturing Co., sold its rutile property at Malvern, Magnet Cove district, Hot Spring County, to the Magnet Cove Rutile Co. early in December 1943. During 21 months of operation the former owner produced 580 short tons of rutile (largely from a stock pile of crude concentrates averaging 52 percent TiO_2 purchased with the property) and shipped 625 tons (45 from stock) averaging 90 percent TiO_2 and valued at $79,500.

Florida.—Riz Mineral Co. operates a concentrator at Melbourne, Brevard County, for the production of rutile, ilmenite, and zircon. The ore feed is sand—formerly from stretches of beaches in the vicinity of Melbourne but now from dunes some 3 miles inland from Vero Beach, Indian River County. In August 1943 Rutile Mining Co. of Florida, subsidiary of Titanium Alloy Manufacturing Co., began to produce rutile and ilmenite from sand dunes about midway between Jacksonville, Duval County, and the Atlantic coast. This company signed a contract with Government-owned Metals Reserve Co. to deliver 2,900 short tons of rutile between June 1943 and April 1944. St. Johns River Lumber & Development Co., St. Augustine, St. Johns County, shipped a small quantity of mixed ilmenite-rutile-zircon concentrate in 1943. In Duval and St. Johns County near Ponte Vedra is a 17-mile beach property which was worked for ilmenite, rutile, zircon, and monazite in 1916–27 by Buckman & Pritchard, Inc., a subsidiary of the National Lead Co. after 1922. Depletion of the best ore and availability of larger and cheaper quantities of ilmenite from abroad led to discontinuance of mining, and the subsidiary (renamed the Ponte Vedra Co.) developed the property residentially and sold it in December 1942.[1] Beach deposits in Santa Rosa, Escambia, and Okaloosa Counties near Pensacola are

[1] National Lead Co., 51st Annual Report for Fiscal Year Ended December 31, 1942, pp. 4–5.

estimated to contain 750,000 ton
kyanite, 1.0 percent ilmenite, 0
rutile.

New York.—The National Lea
1943 mined 985,261 short tons of
Fe) and concentrated 983,759 to
ilmenite (165,198 tons were shipp
398,713 tons of magnetite averagi
and a bottleneck in the crushing p
900 short tons of ilmenite daily,
Five months operation in 1942 y
tons of ilmenite and shipments of
at the property was described.[2]
million tons.[3]

North Carolina.—Ilmenite conc
are produced at Finley, Caldwe
Ilmenite Co., subsidiary of the G
about 40 tons daily is utilized by
tion, St. Helena, Baltimore, Md.
titanium pigments. It is planned
to expand the Yadkin Valley oper
ilmenite, some of which would be a

Oregon.—Although chromite w
black sands of Coos County, the e
materialize.

Texas.—A deposit in Jeff Davi
rutile disseminated in hard, silicifi
87 percent TiO_2 with a recovery of

Virginia.—The American Ruti
Metal & Thermit Corporation,
Roseland, Nelson County. South
subsidiary of the Vanadium Corpo
property in the same district t
subsidiary of Interchemical Corpo

FOREIGN

Imports.—Ilmenite imports in
1942, largely as a result of substant
Receipts from India continued t
shortage of barges to move the
point of export. Rutile imports co
supplied most of the increase, bu
was maintained at its 1942 level.
source of rutile. Titanium is imp
form of mixed zircon-rutile-ilmenit
into their component minerals by

[1] Herres, Otto, and staff, MacIntyre Development
Met., vol. 24, No. 443, November 1943, pp. 509–516.
[2] Balsley, James R., Jr., Vanadium-Bearing Ma
County, N. Y.: Geol. Survey Bull. 940-D, 1943, pp.
[3] Vogel, Felix A., Jr., Preliminary Report on the
Jeff Davis County, Tex.: W. P. A. Statewide Miner
Resources Surv. Circ. 53, August 1942, 8 pp., 4 maps
[4] Engel, A. L., and Shelton, S. M., Progress Repor
of the Ore-Dressing Section, Fiscal Year 1941: Bureau
[5] Figures on imports and exports (unless otherwise
of Mines, from records of the U. S. Department of Co

poration (subsidiary of the American Rutile Corporation and Ventures, Ltd.), Carteret, N. J.; Orefraction, Inc., Pittsburgh, Pa.; and Titanium Alloy Manufacturing Co., Niagara Falls, N. Y. There were no imports of ferrotitanium in 1941–43.

Titanium concentrates [1] imported for consumption in the United States, 1939–43, by countries, in short tons

Country of origin	1939	1940	1941	1942	1943
ILMENITE					
Australia [2]	28	2	364	235	300
Brazil		2	3,709	1,287	
Canada			5,725	4,540	65,437
India and Dependencies	286,548	221,637	156,079	1,165	8,960
Portugal			969		
Total as reported	286,576	221,641	166,846	7,227	74,787
Australia: In "zirconium ore" [3]	615	2,250	3,843	3,180	3,306
Grand total	287,191	223,891	170,689	10,407	78,093
Value of "As reported"	$1,126,200	$750,500	$629,940	$60,490	$380,161
RUTILE					
Australia [2]	343	22	660	1,311	2,802
Brazil	99	128	2,448	4,966	4,920
Cameroun (French) [4]				146	1,095
India and Dependencies					818
Portugal		6			
Total as reported	442	156	3,114	6,423	9,635
Australia: In "zirconium ore" [3]	345	2,008	3,177	4,102	4,703
Grand total	787	2,164	6,291	10,525	14,338
Value of "As reported"	$23,170	$14,849	$300,176	$623,917	$823,624

[1] Classified as "ore" by the United States Department of Commerce.
[2] All imports of titanium from Australia in 1939–43 were in mixed zircon-rutile-ilmenite concentrates. Totals of mixed concentrates are derived by addition of the United States Department of Commerce figures for imports of ilmenite, rutile, and "zirconium ore" from Australia. These totals are divided by the Bureau of Mines (on the basis of surveys of importers) into the three component minerals. The excess quantities of ilmenite and rutile over the quantities reported by the United States Department of Commerce in those specific categories are entered as "In 'zirconium ore.'"
[3] Includes quantities reported by the United States Department of Commerce as originating in French Equatorial Africa, from which no rutile production has been recorded.

Exports.—Titanium products valued at 2½ million dollars were exported in 1943. Most of the concentrates (probably rutile) and alloys went to Canada. Of the pigments, 86 percent went to Canada, and 7 percent was divided about equally between Argentina and Brazil. The quantity of tetrachloride exported was 694 tons—43 percent to United Kingdom, 27 percent to Egypt, 18 percent to India, 11 percent to Algeria, and 1 percent to other countries.

Exports of titanium products from the United States, 1939–43, by classes

Year	Concentrates		Metal and alloys (including ferro-alloys)		Dioxide and pigments		Tetrachloride and other compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	(1)	(1)	(1)	(1)	4,319	$608,063	(1)	(1)
1940	(1)	(1)	(1)	(1)	4,962	867,535	(1)	(1)
1941	[2] 432	[2] $70,613	[2] 150	[2] $35,687	7,821	1,609,071	[2] 17	[2] $5,702
1942	618	117,886	461	60,938	8,870	1,707,433	24	13,666
1943	576	103,947	700	117,402	9,765	1,830,344	728	442,591

[1] Data not available.
[2] Data cover last 6 months only.
[3] Data cover last 4 months only.

TITA

ST

Ilmenite stocks continued to
stituted a 5 months' supply, ev
stocks were little changed.

Stocks of titanium concentrates in the U

Stocks	1942		
	Ilmenite		
	Gross weight	Estimated TiO_2 content	Gross weigh
Mine	11,917	5,142	54
Distributors [1]	11,541	5,371	1,778
Consumers	149,153	81,735	1,906
Government			2,194
Total stocks	172,611	92,248	5,932

[1] Revised.
[2] Includes ilmenite and rutile content of mixed zi

CONSUMPTI

Consumption of ilmenite adva
with 1942, but the increase served
use of lower-grade domestic ore
in pigments (96 percent) and allo
spurted 66 percent, and the app
(70 percent) and alloys (over 29 p

Consumption of ilmenite and rutile in
in sh

Product	Gross wei
1942	
Pigments (manufactured titanium dioxide) [1] [2]	244,
Welding-rod coatings [1]	
Alloys and carbide	11,
Ceramics	
Miscellaneous [3]	1,
Total consumption	257,
1943	
Pigments (manufactured titanium dioxide) [1]	290,
Welding-rod coatings [1]	
Alloys and carbide	10,
Ceramics	
Miscellaneous [3]	1,
Total consumption	302,

[1] "Pigments" include all manufactured titanium
was 4,900 tons in 1942, and 5,700 in 1943.
[2] Partly estimated.
[3] Consists of ilmenite used as a steel flux and rutile

Titanium pigments.—Production of titanium pigments in 1943 was somewhat less than in 1941–42, but sales were greater than in any year except the 1941 peak. The output was approximately three-quarters of capacity, largely because of reductions in the quantity and grade of ilmenite procured. On the other hand, demand greatly exceeded capacity. Government control of distribution was strengthened December 6, 1943 (Order M–353), amended December 24 to include extended pigments containing over 12 percent TiO_2. Titanium dioxide production technology, a comparison of anatase- and rutile-type pigments, and the causes of chalking were described comprehensively.[7] Rutile-type pigments (made from ilmenite but possessing the crystal structure of rutile) have been commercially available only about 3 years and the chalk-resistant type for only 2 years, but already their use is mandatory in a number of Government specifications.[8] Titanium paints such as Ti-Pure and Titanox are noted for covering power, whiteness, and durability and enjoy a greater volume of business than any other white paint. Paper manufacturers have greatly increased their demands for titanium dioxide, a pulp extender that enables reductions as great as 50 percent in paper weight with no loss in opacity.

Welding-rod coatings.—About 481,000 short tons of titanium-coated welding rods were produced in the United States in 1943 compared with 321,000 tons in 1942 and 152,000 tons in 1941. Titanium shields the arc from oxidation during welding and produces a brittle slag that protects the cooling weld deposit.[9] Welding has replaced riveting in much military construction; for example, a Liberty ship uses some 250,000 linear feet of welding in place of 1,000,000 rivets.[10]

Titanium alloys.—Ferrocarbontitanium (15–20 percent Ti, 3–8 percent C) improves the rimming action of steel to be rolled and acts as a deoxidizer in killed steel. Ferrotitanium (18–45 percent Ti, 0.1 percent C max.) prevents intercrystalline embrittlement and weld decay in stainless steel, inhibits brittleness of 5-percent chromium steel, and increases the hardenability of forging steel.[11] Additions of 0.1–0.3 percent Ti to aluminum alloys refine the grain.[12] A titanium predip before phosphoric treatment of surfaces to be zinc plated has been recommended.[13] Titanium-zinc alloys were investigated.[14] Pure titanium metal is used in radio tubes. Titanium carbide is a constituent of hard cutting alloys for machine tools.

Other uses of titanium.—Some steel companies are using 1 part of ilmenite to replace 1 to 4 parts of fluorspar as a flux in making titanium-bearing stainless steel.[15] Titanium tetrachloride, ordinarily made from rutile, is used by the United States Navy to produce smoke screens.

[7] Benett, A. N. C., and Woodhall, W., Progress and Development in Titanium Oxide and Titanium Pigments: Oil and Colour Trades Jour., vol. 104, November 20, 1943, pp. 798–805; Paint Ind. Mag., vol. 59, No. 3, March 1944, pp. 84, 86, 88, 90, 92, 94.

[8] Dawson, D. H., and Troutman, R. E., Rutile Titanium Dioxide in Specification Paints: Paint Ind. Mag., vol. 58, No. 10, October 1943, pp. 336, 338, 340, 342, 344.

[9] Westendarp, H. O., Jr., Arc Welding Electrodes—How They Are Made: Iron Age, vol. 151, No. 17, April 29, 1943, pp. 39–41.

[10] Science News Letter, vol. 43, No. 21, May 22, 1943, p. 322.

[11] Comstock, George F., Boron Plus Titanium in Heat-Treated Steels: Metals and Alloys, vol. 17, No. 5, May 1943, pp. 978–983.

[12] Bonsack, W., Effects of Minor Alloying Elements on Aluminum Casting Alloys. Part II—Aluminum-Silicon Alloys: Bull. Am. Soc. Testing Materials, No. 124, October 1943, pp. 41–51; discussion, No. 126, January 1944, pp. 27–30.

[13] Iron Age, Titanium Predip Process Increases Life of Zinc Coatings: Vol. 153, No. 5, February 3, 1944, p. 55.

[14] Anderson, E. A., Boyle, E. J., and Ramsey, P. W., Rolled Zinc-Titanium Alloys: Am. Inst. Min. and Met. Eng. Metals Technol., vol. 11, No. 2, February 1944, Tech. Pub. 1687, 9 pp.

[15] Metals and Alloys, Ilmenite Ore for Fluorspar: Vol. 18, No. 3, September 1943, p. 680.

PRICE

No price changes affected any forn and rutile prices were fixed by the February 22, 1943 (Regulation 327) 1942. Ilmenite, 60 percent TiO_2, w a long ton, f. o. b. Atlantic seaboar at 8–10 cents a pound. Steel quo $1.23 per pound of contained Ti for 4 for 20- to 25-percent grade; and fer Ti, at $142.50 a short ton for 6- to 8 3- to 5-percent carbon. Titanium m at $5–$5.50 a pound. The base p dioxide remained fixed at 14½–16½ ce

TECHNOL

Types of dynamite stronger and fa are necessary in blasting the dense, N. Y.[16] A feature of the mill at that fier which provides accurate hydra The grinding characteristics of ru those of other minerals.[18]

Concentration of a Caldwell County nearly 70 percent ilmenite, no rutile sericite talc was undertaken on a labo 41 percent TiO_2 and 33 percent Fe concentrated by froth flotation to a TiO_2 and 39 percent FeO. Method or amine acid reagents appear equa recovery of ilmenite was 80 percent, w by re-treatment of middling products at not over 12 cents per ton of ore tre

Titanium ores can be reduced by furnace with ordinary clay and off-gra magnetite is reduced to sponge iron reduction of titanium compounds, the additions of lime and carbon to yield slag.[21] Titanium tetrachloride (a s produced by treating titanium-bearin at 350°–400° C., according to a Germ the most hazardous of 14 metal pow Inc., Beverly, Mass., has established a for research on the properties and ut

[16] Johnson, N. G., How New and Better Industrial Exp and Met., vol. 25, No. 445, January 1944, pp. 18–19.

[17] Counselman, T. B., Ore Concentration and Milling p. 59.

[18] Coe, Glen Dale, and Cogbill, Will H., Contrasts in Bureau of Mines Rept. of Investigations 3704, 1943, 11 pp.

[19] McMurray, L. L., Froth Flotation of a North Carol Mining Technol., vol. 8, No. 1, January 1944, Tech. Pub.

[20] Steel, Deoxidizing and Reduction Agent: Vol. 114, N

[21] Brassert, Herman A. (to Metals and Mineral Corpo centrated Titanium Slag from Ores and Sands Containi vol. 37, No. 17, September 10, 1943, p. 5009.

[22] Walter, Noll (to I. G. Farbenindustrie, A. G.), (Tita 726,429, September 8, 1942; Chem. Abs., vol. 37, No. 21, N

[23] Hartmann, Irving, Nagy, John, and Brown, Hylto Powders: Bureau of Mines Rept. of Investigations 3722,

[24] Chemical and Engineering News, vol. 21, No. 5, Aug