MINER
YEARB

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Volume I of Th

METALS AND

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Prepared by the staff of the
BUREAU OF MINES
DIVISION OF MINERALS
Charles W. Merrill, Chief
Frank D. Lamb, Assistant Chief

TECHNOLOGY

The Federal Geological Survey discovered a deposit of pale-blue dumortierite in Jefferson County, Mont., on the Great Northern Railroad.[4] The deposit is poorly exposed in talus and float along a probable shear zone 30 to 100 feet wide and about 1,000 feet long.

Dumortierite (steel-gray with a dark bluish-lavender tint), was found in veins on the west slope of La Madera Mountain, Petaca District, Rio Arriba County, N. Mex.[5]

An improved synthetic mullite refractory for high-temperature applications in nonferrous foundries, primary steel production, ceramic kilns and furniture, and power plants was developed. Several grades of the refractory are available in the form of brick, special shapes, and ramming mixes.[6]

Refractory mineral wool compositions were made by fusing kyanite and silica to a fluid consistency and fiberizing the mixture. The product is said to be a good high-temperature insulator.[7]

WORLD REVIEW

Africa.—In December 1955 the New Consolidated Gold Fields, Ltd., New York, purchased the Murka mine and other claims of the Kenya Kyanite, Ltd., of Kenya for a reported price of $450,000. A new company, the G. F. K. Refractories, was formed to operate the Kenya properties. Production was expected to begin in late 1956.[8]

Canada.—The Hoyle Mining Co., Ltd., continued its diamond-drilling program on its kyanite property in Dryden township, about 12 miles east of Sudbury, Ontario.[9] Investigations of kyanite ores at the Industrial Minerals Division of the Mines Branch, Ottawa, gave encouraging results on a pilot-plant flotation scale and also on the utilization of kyanite concentrate for the production of mullite. Transportation and power facilities were available for developing this deposit, which is said to contain 20 to 30 percent kyanite.

Nyasaland.—Output of kyanite in Nyasaland totaled 1,624 short tons valued at £14,950 in 1954 (£1 approximates US$2.81). This production was all exported to the United Kingdom.[10]

[4] Geological Survey, Deposit of Dumortierite Discovered in Jefferson County, Mont.: Press release, Feb. 8, 1955, 1 p.
Skillings' Mining Review, vol. 43, No. 48, Mar. 5, 1955, p. 11.
[5] Rocks and Minerals, vol. 30, No. 1112-, November-December 1955, p. 589.
[6] Iron Age, vol. 175, No. 24, June 10, 1955, p. 126.
[7] Hahn, W. P. (assigned to Johns-Manville Corp.), Refractory Mineral Fiber: U. S. Patent 2,699,397, Jan. 11, 1955.
[8] Letter to the Bureau of Mines by the Gold Fields American Development Co., Apr. 13, 1956.
[9] Canadian Mining and Metallurgical Bulletin, Montreal, vol. 48, No. 519, July 1955, p. 466.
[10] Bureau of Mines, Mineral Trade Notes: Vol. 41, No. 2, August 1955, p. 41.

Lead

By O. M. Bishop,[1] A. J. Martin,[1] an

ECONOMIC conditions affecting the States in 1955 improved as the year at the end of the year was the highes sumption of lead increased substantial general expansion of industrial activity. in the last half of the year, excluding strategic stockpile, was 9 percent larger the full year consumption increased 11 p increase in consumption, offerings in res to the National Stockpile decreased also increased in nearly all other countr

The quoted price of common lead in N a pound from January to September 23 fractionally and settled at 15.50 cents advance on December 29 raised the pri The average weighted sales price was 14

Total supplies of lead in the United St 1954 and exceeded consumption for the the excess (69,100 tons) was the smallest increases of 4 percent each in domestic quantity of secondary lead recovered an of pig lead and lead contained in ores and lead supply—1,281,700 tons—39 percent as secondary lead; nearly 35 percent (excluding imported scrap, which normall and is thus included in the secondary out cent was produced by domestic mines. T lead at domestic primary lead refineries d but that of antimonial lead increased 7 lead at the end of 1955 totaled 21,900 to the beginning of the year and the lo smelter stocks of antimonial lead decli A strike lasting from July 1 to August tions of lead smelters at East Helena, M ville, Colo.; and Selby, Calif. (smelter an Omaha, Nebr., and Perth Amboy, N. J.

Domestic mine production of lead, al was 10 percent less than the average for t below imports and secondary metal as a

[1] Commodity specialist.
[2] Statistical assistant.

of the more favorable economic conditions of improved demand and average prices for lead and zinc, mine operations were resumed at several important producing lead-zinc mines. However, due mainly to a prolonged labor strike affecting a number of mines in the Coeur d'Alene region of Idaho and one mine in Montana lead production in the last half of 1955 was 5 percent less than in the first half. Missouri was the principal lead-producing State in the United States for the 48th consecutive year, contributing 37 percent of the total domestic output; Idaho ranked second, with 19 percent, and Utah third, with 15 percent. Of the remaining 29 percent, Montana, Colorado, Oklahoma, Washington, Arizona, and California together produced 22 percent and other States 7 percent.

Domestic lead consumption (including the lead content of ore used in pigments and salts) was 1,212,600 tons, or 117,700 tons more than in 1954. The three largest lead-consuming products—batteries, tetraethyl lead, and cable covering—took 31, 14, and 10 percent, respectively, or a total of 55 percent of all lead consumed. The quantity of lead used in batteries and tetraethyl lead increased 13 and 3 percent, respectively, from 1954, but that used in cable covering decreased 5 percent.

Imports of pig lead and lead contained in ores and concentrates totaled 441,600 tons, a yearly increase of only 1 percent, but imports of lead contained in scrap (20,600 tons) was nearly four times that in 1954. The 264,100 tons imported in the form of pigs and bars in 1955 came largely from Mexico, Australia, Yugoslavia, Canada, and Peru, and most of the 177,500 tons contained in ores and concentrates was obtained from Peru, South Africa, Canada, and Australia. Of the scrap lead imported, about three-fourths was supplied by Canada, Mexico, and Australia.

Exports of primary lead were less than 600 tons in both 1954 and 1955.

World mine production of lead in 1955 was estimated to be 2,370,000 short tons, a 7-percent increase over 1954. World smelter production, estimated at 2,220,000 tons, increased 1 percent. Canada and Mexico were the only large producing countries in which mine production decreased. These two countries, the United States, Argentina, West Germany, and Australia were the only important producers that reported decreases in refined-lead production.

LEGISLATION AND GOVERNMENT REGULATIONS

The Reciprocal Trade Bill passed by the Congress and signed by the President June 21, 1955, extended the Reciprocal Trade Agreements Act for another 3 years and empowered the President to cut tariffs up to 5 percent a year in each of the 3 years. No cut was made in the tariff on lead in 1955.

The Defense Production Act of 1950, with amendments, was extended to June 30, 1956.

The Export Control Act of 1949, still in effect in 1955, required export licenses for exports to all countries except Canada.

Defense Mobilization Order OD–LS 416, dated August 11, 1955, closed the issuance of Certificates of Necessity for a number of minerals, including lead and zinc.

TABLE 1.—Salient statistics of the lead indu
(average) and 1951–55,

	1946–50 (average)	1951
Production of refined primary lead:		
From domestic ores and base bullion	367,418	342,644
From foreign ores and base bullion	66,893	75,049
Total	434,311	417,693
Recovery of secondary lead	459,857	518,110
Imports (general):		
Lead in pigs, bars, and old	264,262	188,175
Lead in base bullion	2,950	2,281
Lead in ores and matte	68,549	67,484
Exports of refined pig lead	1,247	1,281
Consumption of primary and secondary lead	1,091,605	1,184,793
Prices (cents per pound):		
New York:		
Average for period	13.90	17.49
Quotation at end of period	15.61	19.00
London average for period	14.26	20.25
Mine production of recoverable lead [1]	390,182	388,164
World smelter production of lead	1,550,000	[2] 1,810,000

[1] Includes Alaska.
[2] Revised figure.

DEFENSE MINERALS EXPLORATI

The DMEA program to encourage exp
reserves of strategic and critical miner
throughout 1955. On exploration co
Government provided 50 percent of the
Twenty-three such contracts were mad
mum Government participation of $69
an equal amount of private capital for a
of $1,383,944, or an average of $60,172
ning of the program in 1951 through
involving lead and zinc were executed.
participation of $9,719,243 [3] and total ex
ment and private capital) of $19,445,
including a list of DMEA contracts
executed in 1955, is given in the Zinc

GENERAL SERVICES AD

The General Services Administration
sible for stockpile procurement and
under foreign aid programs as agent of
Administration and the new Internati
tion, and administration of Defense Pro
ing domestic purchase programs). GS
by producers of metals and minerals fo
Purchases of lead produced from dome
againt the long-term stockpile objective
for the barter of surplus agricultural
strategic and critical materials pursuan
cultural Trade Development and Assist

[3] Includes sums provided through amendments to contract
contracts that were subsequently canceled or terminated up

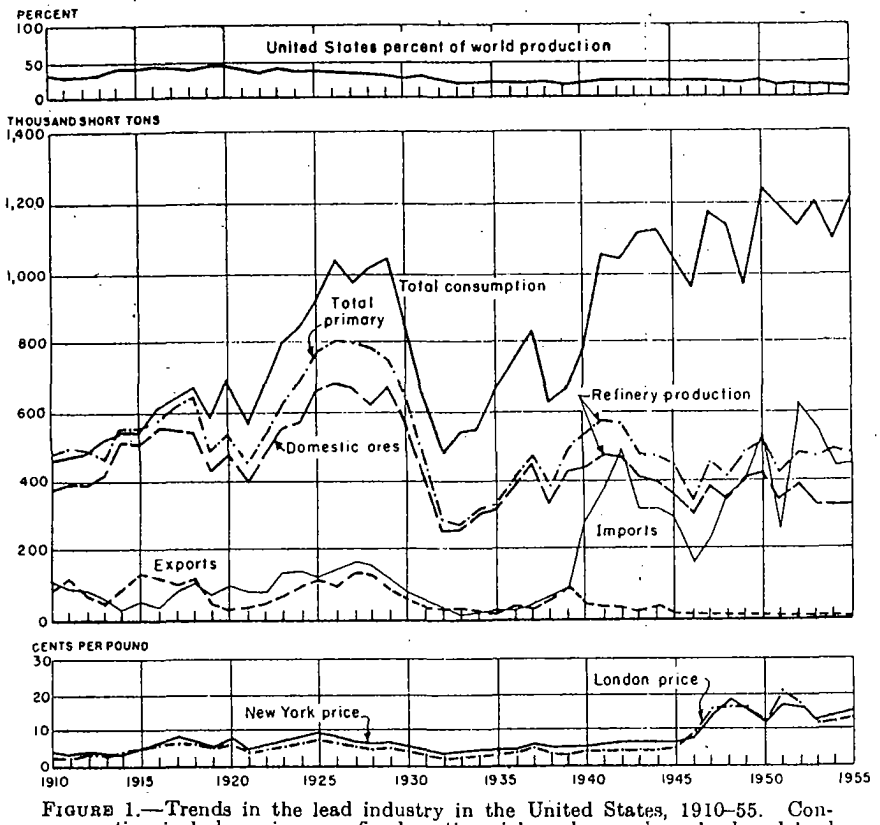

FIGURE 1.—Trends in the lead industry in the United States, 1910–55. Consumption includes primary refined, antimonial, and secondary lead and lead in pigments made directly from ore. Imports are factored to include 95 percent of lead content of ores, mattes, and concentrates and 100 percent of pigs, bars, base bullion, and scrap. Exports include lead that entered the United States under bond.

was carried on with respect to a number of materials, but no lead was acquired under the program during 1955. No new contracts with foreign producers for obtaining lead under the Defense Production Act of 1950 were executed in 1955; some lead produced under contracts negotiated in preceding years was delivered.

DOMESTIC PRODUCTION

Statistics on lead output may be prepared on a mine or smelter and refinery basis. Mine-production data, compiled on the basis of lead content in ore and concentrate, adjusted to account for average losses in smelting, are a better measure of domestic output from year to year and are more accurate for showing the geographic distribution of production. Pig-lead output, as reported by smelters and refiners,

presents a more precise figure of actu
only in a general way the source of cr
and refinery output usually differs fr
owing to the lag between mine shipm
ore and concentrate.

Lead-production data for 1954 w
Bureau of the Census (United State
Comparison of final data reported by
differences. The Bureau of Mines fig
senting recoverable domestic mine p
slightly larger than the Census figure
is due to slightly broader coverage by
inclusion of output of metal containe
material and by mines with product
Some State totals reported by the two
metal derived from ores transported a
credited by the Bureau of Mines to
which the ore was mined, while the
such production to the State in whic

MINE PRODU

The output of recoverable lead from
short tons in 1955, a 4-percent increas
than the 5-year average from 1950–54.
strike that affected a number of mines
Idaho and one mine in Montana, lead
1955 was 5 percent less than that in
proved demand, along with higher a
operations were resumed by several i
shut down for periods ranging from le
because of unfavorable economic co
Missouri, with 125,400 tons, Idaho, w
50,500 tons, together contributed 71
mine output of lead in 1955. Missou
1954; Idaho decreased 7 percent, ar
Output increased in Montana, Washi
and decreased in Colorado and Oklaho

The Southeastern Missouri lead bel
district in the United States for the 48
of recoverable lead in 1955 was 125,40
ranking producing district and 37 per
put. St. Joseph Lead Co., largest p
States, operated its Bonne Terre, De
mine-mill units, its Doe Run and Hay
County (ore milled at the Federal and
Indian Creek mine-mill unit in Washi
daily capacity of the 5 mills in St. Fra
was about 28,000 tons of ore. The co
La Motte mine and a 2,000-ton mill
Lead Co. continued to operate its Madi
town, Madison County.

concentration mill. According to the company annual report (No. 55), ore milled during the fiscal year ended June 30, 1955, totaled 203,000 short tons assaying 18.15 percent zinc, 5.45 percent lead, 0.51 percent copper, and 6.40 ounces of silver, and 1.90 dwt. of gold to the ton. Mill output was 57,100 tons of zinc concentrate averaging 55.3 percent zinc, 9,100 tons of lead concentrate averaging 58.65 percent lead, and 7,500 tons of copper concentrate assaying 8.03 percent copper, 16.25 percent zinc, 38.60 percent lead, and 100.95 ounces of silver, and 28.50 dwt. of gold to the ton. The lead and copper concentrates were exported, and the zinc concentrate was shipped to the company Risdon electrolytic zinc plant.

Lead and Zinc Pigments

By O. M. Bishop[1] and Esthe

THE HIGH LEVEL of construction and 1955 caused a 10-percent greater dem prices for lead and zinc pigments and States than in 1954. Domestic shipments free zinc oxide, zinc chloride, and zinc sulf corresponding shipments in 1954 by 8, 6 respectively. White-lead shipments rem and leaded zinc oxide and lithopone decrea

The larger shipments of pigments and related to expanded activity, particularly important quantities of these products. T automobiles in 1955, at 7.9 million units, w and the production of trucks and buses ros units. Similarly, shipments of automotive 25.4 million units, was 10 percent abov natural and synthetic rubber in automobile to 1.5 million tons. The value of public rose 13 percent, and the value of sales of p materials increased 15 percent in 1955.

Lead and zinc (metal, ore, and scrap), the pigments industry, were in plentiful su the production of lead and zinc pigmen demands. Lead and zinc prices increase stable during 1955.

Lead-pigment price quotations trended u pig-lead prices. Zinc-pigment price quotat the increased price of slab zinc.

Dry white-lead shipments in 1955 increa 1954; the "in-oil" variety decreased 7 perce of white lead essentially equaled those in 1884, when records for this pigment were fi reflected increased competition from othe titanium dioxide, and reduction or eliminati formulations. Tonnages of red lead and exceeded those in 1954 by 2,100 and 8,60 respectively.

[1] Commodity-industry analyst.
[2] Statistical assistant.

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TABLE 1.—Salient statistics of the lead [1] and zinc pigments industry of the United States, 1946–50 (average) and 1951–55

	1946–50 (average)	1951	1952	1953	1954	1955
Production (shipments) [2] of principal pigments:						
White lead (dry and in oil)..... short tons	49,772	35,415	26,663	26,217	25,571	25,575
Red lead.....do	31,863	35,362	30,926	31,333	27,103	29,272
Litharge.....do	150,867	154,753	140,798	154,518	139,877	148,511
Zinc oxide.....do	148,108	147,716	142,210	148,627	140,285	168,541
Leaded zinc oxide short tons	63,513	44,341	37,892	30,712	33,972	32,661
Lithopone.....do	127,209	102,837	61,832	52,439	44,011	42,845
Value of products:						
All lead pigments	$72,471,000	$80,273,000	$72,230,000	$64,303,000	$61,756,000	$69,133,000
All zinc pigments	57,621,400	74,599,000	63,950,000	56,475,000	50,438,000	58,031,000
Total	130,092,400	163,872,000	136,180,000	120,778,000	112,194,000	127,164,000
Value per ton received by producers:						
White lead (dry)	$296	$426	$403	$378	$383	$392
Red lead	313	397	376	312	323	342
Litharge	301	383	348	285	303	320
Zinc oxide	205	311	307	264	255	258
Leaded zinc oxide	216	320	313	259	258	259
Lithopone	106	141	137	132	136	140
Foreign trade:						
Lead pigments:						
Value of exports	$993,800	$984,000	$933,000	$799,000	$872,000	$976,000
Value of imports	256,600	1,797,000	451,000	16,000	149,000	195,000
Zinc pigments:						
Value of exports	4,048,800	6,855,000	4,352,000	1,468,000	1,351,000	1,073,000
Value of imports	274,800	930,000	90,000	287,000	515,000	773,000
Export balance	4,511,200	5,112,000	4,744,000	1,964,000	1,559,000	1,081,000

[1] Excludes basic lead sulfate, data for which are withheld to avoid disclosure of individual company confidential data.
[2] Reported as sales before 1945.

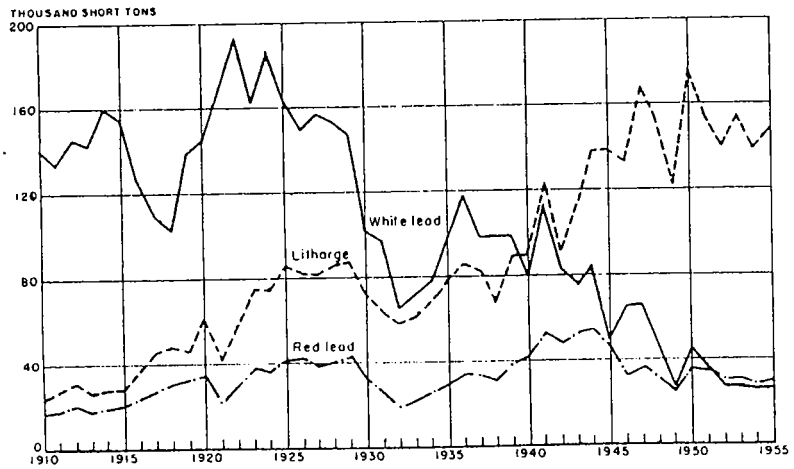

FIGURE 1.—Trends in shipments of lead pigments, 1910–55.

Lead-free zinc oxide shipments incre
rubber, paints, ceramics, and textiles i
zinc oxide declined 4 percent. Litho
cent, indicating decreasing use as a pig

The distribution of pigments to con
the same as in previous years. The pa
principal user of white lead, leaded zin
approximately 78, 99, and 71 percent,
ments of these products. The paint
consumer of red lead, taking 49 percen
duction consumed 20 percent of the zi
cent of the litharge shipped. Storage-
users of litharge and the second-rankin
and 41 percent, respectively, of produ
industry continued to be the leading c
percent of total shipments. Manufa
used small quantities of litharge and li
try, ranking fourth in consumption of l
used 16 percent of all litharge shipme
oxide shipments, 2 percent of red-lea
white-lead shipments.

Titanium pigments continued to fu
lead and zinc pigments in paintmakin
of titanium pigments, based on the ti
lished new records, increasing about 1
over the previous highs established i
pigments has about doubled over the
and zinc pigments, especially white lea
formulations.

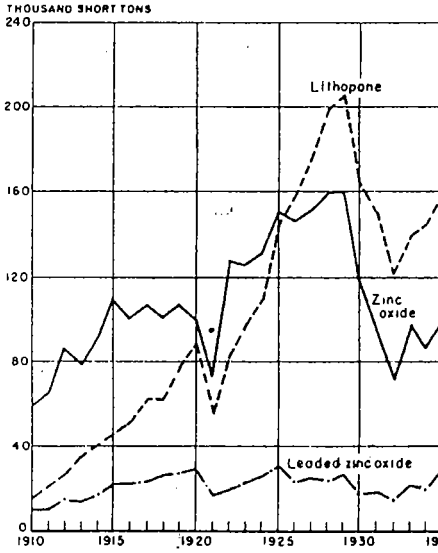

FIGURE 2.—Trends in shipments o

PRODUCERS AND PLANTS

Lead- and zinc-pigments and zinc-salt manufacturers, their plants, and products were listed in the Minerals Yearbook, Volume 1, 1953. There were very few changes in 1954–55.

PRODUCTION

The value of shipments of lead and zinc pigments in 1955 (exclusive of that for basic lead sulfate and zinc sulfide, which cannot be shown) was $127 million, an increase of 13 percent above the 1954 value. Lead pigments comprised 54 percent of the total value and zinc pigments, 46 percent, compared with 55 and 45 percent, respectively, in 1954.

LEAD PIGMENTS

Combined shipments of the lead pigments increased 6 percent in quantity and 12 percent in value in 1955. The average value of white lead (dry) in 1955 was $392 per ton compared with $383 per ton in 1954; red lead averaged $342 per ton compared with $323 in 1954; litharge averaged $326 per ton compared with $303 per ton in 1954.

TABLE 2.—Production and shipments of lead pigments [1] in the United States, 1954–55

Pigment	1954				1955			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Short tons	Value [2]			Short tons	Value [2]	
			Total	Average			Total	Average
White lead:								
Dry	17,359	17,235	$6,593,680	$383	18,249	17,858	$7,005,318	$392
In oil [3]	8,479	8,336	3,990,053	479	7,861	7,717	3,638,660	472
Red lead	26,906	27,163	8,765,907	323	29,017	29,272	10,018,471	342
Litharge	140,084	139,877	42,401,256	303	148,345	148,511	48,470,892	326

[1] Except for basic lead sulfate and orange mineral, figures for which are withheld to avoid disclosure of individual company confidential data.
[2] At plant, exclusive of container.
[3] Weight of white lead only, but value of paste.

TABLE 3.—Lead pigments [1] shipped by manufacturers in the United States, 1946–50 (average) and 1951–55, in short tons

Year	White lead			Red lead	Orange mineral	Litharge
	Dry	In oil	Total			
1946–50 (average)	29,343	20,429	49,772	31,863	26	150,867
1951	23,360	12,056	35,416	35,852	.....	154,753
1952	15,779	10,884	26,663	30,926	.....	140,798
1953	16,784	9,433	26,217	31,333	.....	154,518
1954	17,235	8,336	25,571	27,163	(2)	139,877
1955	17,858	7,717	25,575	29,272	(2)	148,511

[1] Excludes basic lead sulfate, and orange mineral, data for which are withheld to avoid disclosure of individual company confidential data.
[2] Bureau of Mines not at liberty to publish.

Battery makers produced 113,800 t
of lead in 1955 for their own use in pl
compares with 79,000 tons in 1954 an
suboxide production required 109,000 t
tons in 1954, and 78,000 tons in 1953
ducing suboxide of lead reported in 195

ZINC PIGMENTS

Total shipments of the principal zinc
in quantity and 15 percent in value in
zinc oxide, the most important zinc p
increased 20 percent. Shipments of lea
cent, and shipments of lithopone decre

Average values of zinc pigments, as
equaled the 1954 prices. The average
in 1955 increased $3 per ton to $258;
ton to $259; lithopone advanced $5 per

Shipments of the zinc salts, zinc chlor
12 and 25 percent, respectively, in 195
chloride (50° B.) increased $2 per ton
ceived for zinc sulfate decreased 7 perc

TABLE 4.—Production and shipments of zinc
States, 1954–

Pigment or salt	1954		
	Production (short tons)	Shipments	
		Short tons	Value [2]
			Total
Zinc oxide [3]	135,908	140,285	$35,742,797
Leaded zinc oxide [3]	34,318	33,972	8,765,719
Lithopone	30,090	44,011	5,929,789
Zinc chloride, 50° B.	52,241	48,252	4,357,178
Zinc sulfate	18,496	19,027	3,004,621

[1] Excludes zinc sulfide, data for which are withheld to avoid
data.
[2] Value at plant, exclusive of container.
[3] Zinc oxide containing 5 percent or more lead is classed as le
zinc oxide include a small quantity containing less than 5 pe

TABLE 5.—Zinc pigments [1] and salts shipped
States, 1946–50 (average) and 19

Year	Zinc oxide	L zin
1946–50 (average)	148,103	
1951	147,716	
1952	142,210	
1953	148,627	
1954	140,285	
1955	168,541	

[1] Excludes zinc sulfide, data for which are withheld to avoid
data.

Zinc Oxide.—Lead-free zinc oxide shipments increased 20 percent from the 1954 total. The proportion of production by different processes, as given in table 6, showed little change.

TABLE 6.—Production of zinc oxide (lead-free) by processes, 1946–50 (average) and 1951–55, as percent of total

Process	1946–50 (average)	1951	1952	1953	1954	1955
American process (ore and primary residues)	73	75	74	74	68	69
French process (metal and scrap)	17	18	20	20	21	21
Other	10	7	6	6	11	10
Total	100	100	100	100	100	100

Leaded Zinc Oxide.—Shipments of leaded zinc oxide decreased 4 percent and were the smallest since 1935.

Four grades of leaded zinc oxide, classified according to lead content, were produced in the United States. The 5- to 35-percent grade constituted most of the output; smaller quantities were produced as less than 5-percent grade, over 35- to 50-percent grade, and over 50-percent grade. Outputs in 1955 (comparison with 1954 in parentheses) follow: 27,900 (30,300) tons of 35 percent lead and under and 1,900 (4,000) tons of over 35 percent lead.

Lithopone.—Shipments of lithopone dropped 3 percent from the 1954 total and were the lowest since 1914.

The lithopone statistics in this report are given on the basis of ordinary lithopone sold as such plus the ordinary lithopone content of the high-strength product.

Consumption of ordinary lithopone in manufacturing titanated lithopone has decreased almost continuously since 1937, when 19,400 tons was used in making the titanated variety. The Bureau of Mines is not at liberty to divulge the 1954 or 1955 production of titanated lithopone or of regular lithopone used in its manufacture, but the tonnage of regular lithopone so consumed in 1953 was 60 percent below the quantity so used in 1952 and the smallest on record to that time.

TABLE 7.—Titanated lithopone produced in the United States and ordinary lithopone used in its manufacture, 1946–50 (average) and 1951–55, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year	Titanated lithopone produced	Ordinary lithopone used
1946–50 (average)	3,620	2,970	1953	360	300
1951	1,550	1,300	1954	(1)	(1)
1952	900	750	1955	(1)	(1)

[1] Figure withheld to avoid disclosure of individual company confidential data.

RAW MATERIALS USED

Kinds and quantities of raw materials used in making each pigment and salt in 1954 and 1955 are shown in tables 8 and 9.

White lead, red lead, litharge, and orange mineral were manufactured directly or indirectly from pig lead and contained 96 percent of

all lead used in pigments. The lead
supplied the remaining 4 percent of the
lead sulfate and lead silicate are not rep
basic lead sulfate may enter into leaded

Zinc pigments and salts can be ma
materials, including ore, refined metal,
as scrap metal, residues, drosses, skim

Zinc oxide was the only pigment fo
was used. Zinc oxide, leaded zinc oxid
zinc sulfide were manufactured from o
zinc contained in lithopone and all tha
the United States was derived from se
portion of zinc oxide production deriv
creased to 32 percent in 1955, compa

TABLE 8.—Lead content of lead and zinc
manufacturers, by sources, 19

Pigment	1954			
	Lead in pigments produced from—			To lead pi mer
	Ore		Pig lead	
	Domestic	Foreign		
White lead			20,670	20,
Red lead			24,390	24,
Litharge			131,016	131,
Leaded zinc oxide	5,240	2,729		7,
Total	5,240	2,729	176,076	184,

[1] Excludes lead in basic lead sulfate and orange mineral, da
of individual company confidental data.

TABLE 9.—Zinc content of zinc pigments[1]
manufacturers, by sources, 195

Pigment or salt	1954				
	Zinc in pigments and salts produced from—				Tot zinc in pig men and salt
	Ore		Slab zinc	Secondary material[2]	
	Domestic	Foreign			
Zinc oxide	53,112	19,969	18,584	17,051	108,71
Leaded zinc oxide	11,207	6,553			17,76
Lithopone	3,061	2,883		1,593	7,53
Total pigments	67,380	29,405	18,584	18,644	134,01
Zinc chloride				12,271	12,27
Zinc sulfate	1,418	1,044		3,907	6,36

[1] Excludes zinc sulfide, data for which are withheld to avoid di
data.
[2] These figures are higher than those shown in the report on S
include zinc recovered from byproduct sludges, residues, etc., n
[3] Bureau of Mines not at liberty to publish.
[4] Includes zinc sulfate production.
[5] Include

CONSUMPTION AND USES

LEAD PIGMENTS

White lead.—White lead was used principally in paintmaking; shipments to the paint industry comprised 78 percent of the total. In 1955, however, and in other recent years, the percentage used in paint was not properly indicated by available statistics. It is likely that a substantial part of the entire "Other" classification belongs properly under paint. Shipments to ceramic makers and manufacturers of plasticizers and stabilizers were 2 and 5 percent, respectively, of total distribution in 1955.

TABLE 10.—Distribution of white lead (dry and in oil) shipments,[1] by industries, 1946–50 (average) and 1951–55, in short tons

Industry	1946–50 (average)	1951	1952	1953	1954	1955
Paints	44,455	28,718	21,223	21,030	20,029	19,826
Ceramics	1,422	1,548	1,079	786	487	484
Other	3,895	[2] 5,149	[2] 4,361	[2] 4,402	[2] 4,155	[2] 5,266
Total	49,772	35,415	26,663	26,217	25,671	25,575

[1] Excludes basic lead sulfate, data for which are withheld to avoid disclosure of individual company confidential data.
[2] Includes the following tonnages for plasticizers and stabilizers: 1951—1,003; 1952—986; 1953—1,089; 1954—1,133; 1955—1,355.

Basic Lead Sulfate.—Substantial quantities of lead sulfate were used as an intermediate product in manufacturing leaded zinc oxide. Such quantities have always been shown in this chapter under leaded zinc oxide to avoid disclosure of individual company confidential data on basic lead sulfate.

Red Lead.—The paint industry, the principal consumer, received 49 percent of all shipments of red lead in 1955. Storage-battery makers (the leading users until 1953) received 41 percent of total shipments in 1955 compared with 44 percent in 1954. The ceramic industry consumed about 2 percent of the red lead shipped.

TABLE 11.—Distribution of red-lead shipments, by industries, 1946–50 (average) and 1951–55, in short tons

Industry	1946–50 (average)	1951	1952	1953	1954	1955
Paints	16,898	14,740	13,149	14,570	12,668	14,308
Storage batteries	11,056	16,722	13,706	13,075	12,062	11,998
Ceramics	1,013	834	388	1,188	1,207	667
Other	2,896	3,056	3,593	1,600	1,320	2,299
Total	31,863	35,352	30,020	31,333	27,163	29,272

Orange Mineral.—Orange mineral was used in manufacturing ink.

Litharge.—About two-thirds of litharge shipments are usually directed to storage-battery makers. In 1955 the proportion was 61 percent, compared with 68 and 67 percent in 1954 and 1953, respectively. The ceramics industry was the second-ranking consumer of

litharge in 1955, taking 24,200 tons or
Shipments for making chrome pigmen
mained well below the level of other r
secticides and varnish increased 41
Total shipments for all purposes increa

TABLE 12.—Distribution of litharge shipmer
and 1951–55, in s

Industry	1946–50 (average)	1951
Storage batteries	94,209	94,064
Ceramics	18,515	22,815
Chrome pigments	9,227	11,117
Varnish	4,123	5,584
Oil refining	6,765	6,068
Insecticides	8,717	5,691
Rubber	2,323	2,641
Floor coverings	136	1,772
Other	6,852	5,001
Total	150,867	154,753

ZINC PIGMENTS A

Zinc Oxide.—Shipments of lead-f
industries followed the distribution i
industry and paint manufacturers wer
51 percent (51 percent in 1954) and 2
respectively, of total shipments. Shi
increased 22 percent to 86,700 tons
ceramics and coated fabrics and texti
and 7 percent, respectively, of the tota
industries increased in 1955, surpassi
by 5 percent.

TABLE 13.—Distribution of zinc oxide shipme
and 1951–55, in s

Industry	1946–50 (average)	1951
Rubber	78,072	71,507
Paints	32,067	32,934
Coated fabrics and textiles [1]	8,020	7,265
Ceramics	10,479	10,324
Floor coverings	3,771	3,114
Chemical warfare		
Other	15,699	22,572
Total	148,108	147,716

[1] Includes the following tonnages for rayon: 1951—5,275;
[2] Included under "Other."

Leaded Zinc Oxide.—Leaded zinc ox
exclusively as a pigment in paint prod
not used in paint (about 1 percent) wa
and miscellaneous minor products.

TABLE 14.—Distribution of leaded zinc oxide shipments, by industries, 1946–50 (average) and 1951–55, in short tons

Industry	1946–50 (average)	1951	1952	1953	1954	1955
Paints	61,332	43,678	37,607	30,276	33,690	32,178
Rubber	176	82	9	41	7	483
Other	2,005	681	276	395	275	
Total	63,513	44,341	37,892	39,712	33,972	32,661

Lithopone.—Lithopone was used principally in manufacturing paint, varnish, and lacquer. In 1955, shipments to the paint industry comprised 71 percent (73 percent in 1954) of total shipments. Although paint shipments increased 1 percent in 1955, shipments of lithopone to the paint industry declined 5 percent below 1954 and 31 percent below the 1946–50 average. Lithopone was also used in coated fabrics and textiles (10 percent) and in floor coverings, paper, rubber, and printing ink. Although generally declining over the past decade, 1955 shipments of lithopone for these uses increased 4 percent, only 44 percent of the average shipment in 1946–50.

TABLE 15.—Distribution of lithopone shipments, by industries, 1946–50 (average) and 1951–55, in short tons

Industry	1946–50 (average)	1951	1952	1953	1954	1955
Paint, varnish, and lacquers [1]	99,875	76,014	45,267	37,452	32,177	30,522
Coated fabrics and textiles	7,806	4,814	5,698	5,806	3,995	4,242
Floor coverings	8,138	4,620	3,009	2,575	2,351	2,378
Rubber	3,244	3,295	1,523	1,723	1,701	2,163
Paper	3,618	6,462	3,089	2,096	1,841	1,970
Printing ink	(2)	808	657	716	105	1,570
Other	5,028	6,164	2,589	2,071	1,751	
Total	127,209	102,837	61,832	52,439	44,011	42,845

[1] Includes a small quantity, not separable, used for printing ink, except in 1951 and 1952.
[2] Included with "Other" before 1950, except for those quantities reported under "Paint, varnish, and lacquers."

TABLE 16.—Distribution of zinc sulfate shipments, by industry, 1946–50 (average) and 1951–55, in short tons

Industry	1946–50 (average)	1951		1952		1953		1954		1955	
	Gross weight	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis
Rayon	9,510	10,073	7,925	8,181	6,812	9,008	7,612	6,615	5,740	10,732	9,537
Agriculture	6,824	5,588	4,847	5,111	4,446	6,773	5,804	7,067	6,139	8,187	7,089
Chemicals	1,837	2,871	2,243	1,675	1,489	2,539	2,105	2,360	1,973	(1)	(1)
Glue	546	396	337	391	329	601	501	668	545	(1)	(1)
Electrogalvanizing	316	190	129	342	243	337	225	454	301	258	177
Flotation reagents	1,140	858	736	1,070	950	736	648	367	317	226	202
Paint and varnish processing	242	32	20	172	130	106	70	150	114	(1)	(1)
Textile dyeing and printing	179	1,400	1,163	350	301	155	138	4	4		
Other	1,800	2,116	1,274	2,295	1,422	1,965	1,219	1,412	1,024	4,461	3,343
Total	22,394	23,524	18,674	19,587	16,122	22,220	18,412	19,027	16,157	23,864	20,348

[1] Included with "Other."

Zinc Chloride.—The principal uses
and tinning fluxes, battery manufactu
fiber, wood preserving, oil refining, and

Zinc Sulfate.—The rayon industry w
sulfate in 1955. Of the total, shipm
(fertilizers and fungicides) required 35
rayon, 47 percent (35 percent in 1954)
galvanizing, and paint and varnish p
shipments for chemicals, flotation rea
printing decreased by 4 percent from

PRICES

Total and average values received b
pigments and zinc salts are given in tab
ues of litharge, red lead, and white le
per ton, respectively, in 1955 but rem
highs established in 1951. The avera
lead at New York was 15.14 cents, com
The average weighted sale price of le
compared with 13.70 cents in 1954.

Average values received for zinc oxid
pone (zinc pigments), increased $3, $1,
in 1955. The average quoted price of
cents per pound, compared with 10.6
weighted sale price for all grades of slab
compared with 10.80 cents in 1954.

TABLE 17.—Range of quotations on lead pig
at New York (or delivered in the East),

[Oil, Paint and Drug R

Product	1952
White lead (basic lead carbonate), dry, carlots, bags	16.25–20.1
Basic lead sulfate (sublimed lead), less than carlots, bags	15.75–20.1
Red lead, dry, 95 percent or less, less than carlots, barrels	17.25–22.5
Orange mineral, American, less than carlots, barrels	19.00–24.9
Litharge, commercial, powdered, less than carlots, barrels	16.25–21.6
Zinc oxide:	
American process, lead free, bags, carlots	14.25–17.6
American process, 5 to 35 percent lead, bags, carlots	14.40–18.3
French process, red seal, bags, carlots	15.25–18.8
French process, green seal, bags, carlots	16.00–19.3
French process, white seal, bags, carlots	16.50–19.8
Lithopone, ordinary, less than carlots, bags	8.25– 8.9
Zinc sulfide, less than carlots, bags, barrels	20.3
Zinc chloride, works:	
Solution, tanks	4.10– 5.3
Fused, drums	9.00– 9.8
Zinc sulfate, crystals,[1] less than carlots, barrels	18.10–11.2

[1] Includes granulated.

FOREIGN TRADE [3]

Foreign trade in lead and zinc pigments and salts was of comparatively minor importance in relation to domestic shipments. Tonnage and value in 1955 increased 50 percent over 1954 for imports, but declined 14 percent and 5 percent, respectively, for exports. The value of imports was $1.2 million compared with $751,000 in 1954. The value of the principal exports was $2.3 million, compared with $2.4 million in 1954.

As in 1954, imports of lead pigments were small consisting chiefly of litharge, which totaled 750 tons (600 tons in 1954). Imports of zinc products included 3,300 tons of zinc oxide, 600 tons of zinc sulfate, 500 tons of zinc chloride, and 300 tons of zinc sulfide.

The United States exported comparatively little litharge, white lead, lead arsenate, and red lead in 1955; the totals constituted only a small portion of shipments by domestic producers. Pigments (covered by this report) exported in greatest quantity from the United States were zinc oxide and lithopone; tonnage of the two commodities comprising 2 and 4 percent, respectively, of total shipments by producers, decreased 15 and 37 percent, respectively, in 1955.

TABLE 18.—Value of foreign trade of the United States in lead and zinc pigments and salts, 1953–55

[U. S. Department of Commerce]

	Imports for consumption			Exports		
	1953	1954	1955	1953	1954	1955
Lead pigments:						
White lead	$44			$219,514	$280,901	$284,735
Red lead	47	$508	$923	163,830	124,613	133,580
Litharge	15,281	134,413	174,895	425,848	457,078	558,029
Other lead pigments	678	14,219	18,708	(1)	(1)	(1)
Total	16,050	149,140	194,526	(1)	(1)	(1)
Zinc pigments:						
Zinc oxide	275,122	[2] 476,913	686,186	883,821	897,065	771,021
Zinc sulfide	6,460	31,868	83,732	(1)	(1)	(1)
Lithopone	5,658	7,029	4,355	584,270	454,461	300,960
Total	287,240	[2] 514,800	773,273	1,468,100	1,351,526	1,072,581
Lead and zinc salts:						
Lead arsenate				83,139	161,607	215,206
Other lead compounds	6,457	[2] 20,337	72,089	10,573	23,555	21,181
Zinc arsenate	27		1,760	(1)	(1)	(1)
Zinc chloride	25,379	34,075	72,309	(1)	(1)	(1)
Zinc sulfate	3,968	32,957	50,301	(1)	(1)	(1)
Total	35,821	[2] 87,369	202,519	(1)	(1)	(1)
Grand total	339,111	[2] 751,309	1,170,318	(1)	(1)	(1)

[1] Data not available.
[2] Owing to changes in tabulating procedures by the U. S. Department of Commerce, data known not to be comparable to earlier years.

[3] Figures on imports and exports compiled by Mae B. Price and Elsie D. Page, Division of Foreign Activities, Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 19.—Lead pigments and salts exp (average) an

[U. S. Department

Year		
	White lead	Red l
1946–50 (average)	790	
1951	767	
1952	675	
1953	818	
1954	951	
1955	957	

[1] Classification established 1949; quantity and value no

TABLE 20.—Lead pigments and salts imp States, 1946–50 (avera

[U. S. Department o

Year		Sho		
	White lead (basic carbonate)	Red lead	Litharge	L sub
1946–50 (average)	262	83	321	
1951	2,575	215	1,855	
1952	390	2	621	
1953	(1)	(1)	60	
1954		2	596	
1955		3	751	

[1] Less than 1 ton.
[2] Owing to changes in tabulating procedures by the U. S be comparable to earlier years.

TABLE 21.—Zinc pigments and salts impor States, 1946–50 (averag

[U. S. Department of

Year	Short			
	Zinc oxide		Litho-pone	Zi sulf
	Dry	In oil		
1946–50 (average)	1,103	(1)	243	
1951	1,772	10	704	
1952	173	(1)	11	
1953	1,157	29	30	
1954	2,348		65	
1955	8,320		30	

[1] Less than 1 ton.
[2] Owing to changes in tabulating procedures by the U. S. be comparable to earlier years.

TABLE 22.—Zinc pigments exported from the United States, 1946–50 (average) and 1951–55

[U. S. Department of Commerce]

Year	Short tons		Total value	Year	Short tons		Total value
	Zinc oxide	Lithopone			Zinc oxide	Lithopone	
1946–50 (average)	9,363	13,027	$4,049,031	1953	2,971	3,927	$1,468,100
1951	8,895	20,473	6,854,600	1954	3,111	3,013	1,351,526
1952	7,615	9,985	4,352,809	1955	2,649	1,892	1,072,581

Lim

By Oliver Bowles,[1] Annie L. Mc

LIME output in the United States
of 10.5 million short tons compa
and was 8 percent greater than
1953. Open-market sales in 1955 to
increase of 24 percent over 1954.
category showing a decline in 1955; s
than in 1954. Sales for building us
chemical and industrial applications
activity in the metallurgical industri
increase in sales of refractory lime (
total sold or used, 59 percent was in t
hydrated lime, and 20 percent dead-b

**TABLE 1.—Salient statistics of lime sold c
(average) and**

	1946–50 (average)	1951
Active plants	178	
Sold or used by producers:		
By types:		
Quicklime, short tons	3,585,676	4,369,
Hydrated lime, do	1,761,580	1,919,
Dead-burned dolomite, do	1,419,218	1,966,
Total lime:		
Short tons	6,766,474	8,255,
Value [1]	$68,517,829	$96,934,
Per ton	$10.13	$11.
Total open-market lime, short tons	6,387,477	7,720,
Total captive tonnage lime, short tons	[2] 378,097	[2] 535,
By uses:		
Agricultural, short tons	341,907	343,
Building, do	1,059,084	1,234,
Chemical and industrial, do	3,946,255	4,711,
Refractory (dead-burned dolomite), short tons	1,419,218	1,966,
Imports for consumption, do	31,385	34,
Exports, do	51,566	63,

[1] Selling value, f. o. b. plant, excluding cost of containe
[2] Incomplete figures; before 1953 there was only a partia

Figure 1 shows the relation of buil
new building construction. A fair
1950, but thereafter building-lime o
struction.

Because of the many industrial and
put of chemical and refractory lime h

[1] Commodity specialist.
[2] Statistical assistant.

Titaniu

By Jesse A. M

DUE TO increased quality, reducti
production, titanium metal gained
tural material in 1955. Increas
nonmetal uses resulted in record-high d
and titanium pigments. Domestic r
below the peak established in 1947. T
be the world's largest consumer of ilmeni
previous highs established in former yea

The supply of titanium-sponge metal
during 1955; therefore, Government a
additional sponge facilities was suspe
of the year supply and demand for ti
balance. Most titanium metal produce
market in military airframes and en

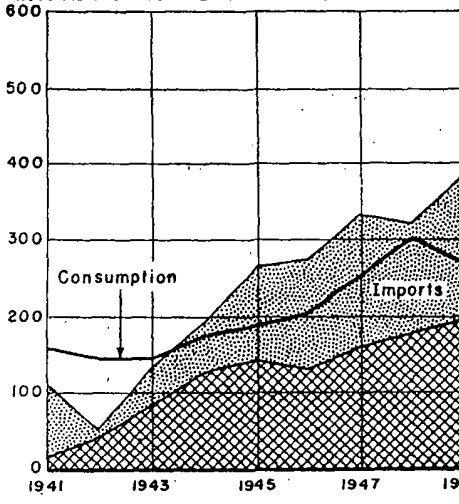

FIGURE 1.—Domestic production, imports, and
titanium slag and a mixed pr

[1] Commodity specialist.

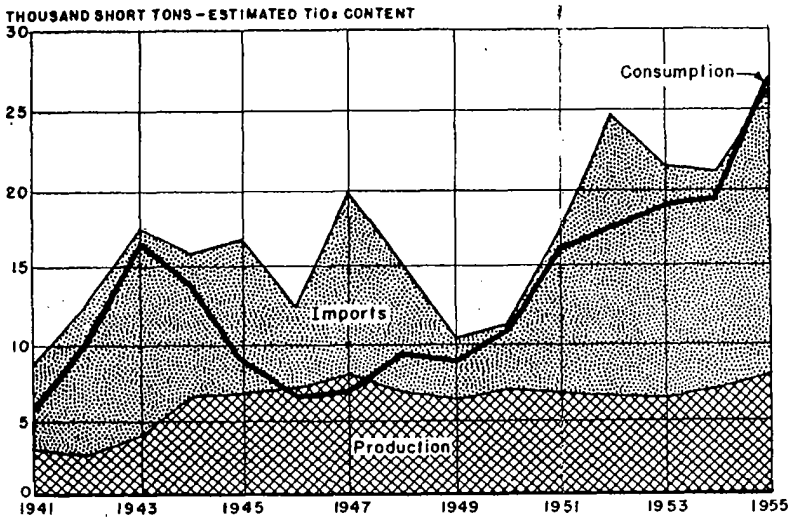

FIGURE 2.—Domestic production, imports, and consumption of rutile, 1941–55.

industry began to realize the value of titanium in certain applications as the results of use tests of prototype equipment were made public.

The price of titanium sponge metal decreased 23 percent, and mill-product base prices decreased as much as 12 percent. Because of a worldwide shortage of rutile, spot prices for these concentrates doubled, while ilmenite prices remained relatively constant in 1955.

Production of ilmenite and rutile increased on a worldwide basis with the United States the leading ilmenite producer and Australia the leading rutile producer. Titanium-slag production in Canada, the sole North American producer, was greater than ever before as demand from the United States for this material remained unsatisfied.

The first titanium-sponge-metal plant to use the sodium-reduction process began operations in the United Kingdom in the middle of the year. Of the three countries producing titanium sponge metal on a commercial basis in 1955, the United States continued to be the largest, followed by Japan and the United Kingdom.

Many of the technological problems besetting the titanium-metal industry were solved during the year. Chief of these was recognition of the role of hydrogen in the delayed cracking of titanium parts. Methods were suggested for welding, casting, extruding, and fabricating titanium in general, and a large quantity of technical literature became available to the public.

GOVERNMENT REGULATIONS

On August 11, 1955, the Office of Defense Mobilization suspended the expansion goals on rutile, titanium-sponge facilities, titanium-melting facilities, and titanium-processing facilities (Defense Mobiliza-

tion Order VII–6, Supplement 1). OD
sponge facilities on September 29, 19
rutile, titanium-melting facilities, and
(Defense Mobilization Order VII–6,
goal was increased 10,000 tons to 3
December 31, 1955. The goals on m
were reopened at 37,500 tons each, the
1954. The last titanium-sponge-met
at 25,000 tons in August 1953.

Government assistance for the cre
sponge capacity was suspended by th
428) September 12, 1955. This progra
expansion goals and included such ince
of certain quantities of sponge in excess
building of plants. Contracts signed
past titanium-metal expansion program
output of 21,600 short tons in 1957. O
were to continue. This action was t
submitted to ODM by Harold S. Vance
was recommended by Vance and the D
General Services Administration (GSA
ness specifications, which will achiev
uniformity of titanium sponge in case
and hold purchases of titanium sponge
continuing development of a better pro
production facilities. It was also recor
of Defense should make every effort to
military equipment on a production l
cost. The last recommendation wou
fabrication technology and lead to pro

DOMESTIC PROD

Concentrates.—Domestic ilmenite pro
set record highs of 583,000 and 573,00
ceeding the previous highs established i
content of ilmenite shipments ranged f
Ilmenite included a quantity of mixe
ilmenite, leucoxene, and rutile. The
manufacturing titanium pigments an
duced in 1955 by the American Cyan
Baumhoff-Marshall Inc., Boise, Idaho
& Co., Inc.; Starke and Lawtey, Fla.
Melbourne, Fla.; the Hobart Bros. Co
Canadian Dredging Corp., Cascade,
Tahawus, N. Y.; Rutile Mining Co.
and Titanium Alloy Manufacturing D
Co., Jacksonville, Fla.

Rutile production in the United State
an increase of about 1,100 tons from 19
high record of 8,562 tons set in 1947.
trate were 9,182 tons in 1955, an incre
Rutile was produced in 1955 by the

Melbourne, Fla.; Hobart Bros. Co., Winter Beach, Fla.; Marine Minerals, Inc., Aiken, S. C.; Rutile Mining Co. of Florida, Jacksonville, Fla.; and Titanium Alloy Manufacturing Division of the National Lead Co., Jacksonville, Fla.

TABLE 1.—Production and mine shipments of titanium concentrates from domestic ores in the United States, 1946–50 (average) and 1951–55, in short tons

	Production (gross weight)	Shipments		
		Gross weight	TiO_2 content	Value
ILMENITE [1]				
1946–50 (average)	375,672	369,372	177,396	$5,530,506
1951	535,835	510,840	261,982	7,689,272
1952	528,588	522,515	265,596	8,022,752
1953	513,696	512,176	258,247	7,222,641
1954	547,711	531,895	270,651	7,375,344
1955	583,044	573,192	297,835	10,267,647
RUTILE				
1946–50 (average)	7,588	6,967	6,498	578,510
1951	7,189	10,919	10,166	645,000
1952	7,125	6,874	6,416	715,491
1953	6,825	6,476	6,043	702,791
1954	7,411	7,305	6,822	869,677
1955	8,513	9,182	8,617	1,122,000

[1] Includes a mixed product containing altered ilmenite, rutile, and leucoxene for 1949–55, inclusive.

On September 30 the National Lead Co. announced that it had supplemented its titanium-ore reserves by discovery of a large titanium deposit within 1½ miles of its Tahawus, N. Y., mine and by the purchase of 6,800 acres of land containing ilmenite sand at Trail Ridge, Fla.[2] Reportedly, ore reserves of 50 million tons have been proved to date at the New York deposit, and indications are that the deposit contains over 100 million tons of ore. The Florida reserves are expected to yield 5 million tons of ilmenite in 270 million tons of sands available for economic processing.

It was made public in September that E. I. du Pont de Nemours & Co., Inc., had leased 11,000 acres of land near Camp Blanding, Fla., thus increasing its holdings near its Highland mine to 18,000 acres. Royalty payments were reportedly 65 cents per gross ton of mineral produced to be split between the Federal and State Governments.[3]

Dredging operations conducted by Baumhoff-Marshall, Inc., and Idaho-Canadian Dredging Co. in the Cascade area, Valley County, Idaho, ceased in August 1955, reportedly because of a drop in monazite prices. The two companies recovered ilmenite as a byproduct from monazite operations.

Metal.—Domestic commercial production of titanium sponge metal established a record high of 7,400 short tons in 1955, a 38-percent increase above the previous record set in 1954. Sponge was made at commercial operations of E. I. du Pont de Nemours & Co., Inc., Newport, Del.; Titanium Metals Corporation of America, Henderson, Nev.; Dow Chemical Co., Midland, Mi

[2] Wall Street Journal, National Lead Lists 3 New Titanium Finds: Vol. 146, No. 65, Oct. 3, 1955, p. 4.
[3] Mining World, Du Pont Acquires More Florida Acreage to Substantially Increase Ilmenite Holdings: Vol. 17, No. 10, September 1955, p. 105.

tanooga, Tenn. It was also produced a
the Bureau of Mines Electrometallurg
Boulder City, Nev. Du Pont and TM
turers. All commercial sponge produce
nesium reduction of titanium tetrachlorid

TABLE 2.—Salient statistics of the titanium 1948–55

Year	Sponge production [1]	Sponge in revolving-fund stockpile Dec. 31	Mill-shape production	Y
1948	[2] 10		(3)	1952
1949	[2] 25		(3)	1953
1950	[2] 75		(3)	1954
1951	495		[2] 75	1955

[1] Unconsolidated commercially pure metal in various forms.
[2] Estimate.
[3] Data not available.
[4] Shipments.

Titanium sponge purchased by the G
under a General Services Administration
totaled 3,753 short tons, thus increasing t
stockpile to 6,647 tons. Government ag
de Nemours & Co., Inc., Wilmington,
Corporation of America, New York, N
sponge under this program terminated Se

The Bureau of Mines entered into a coo
Wah Chang Corp., Glen Cove, N. Y., on
the Bureau to conduct research and de
process for the production of titanium-sp
Bureau titanium pilot plant at Boulder
for the project, which was to terminate M
was completed.

GSA entered into a cooperative agree
with the Bureau of Mines on September
2-year program of research and develop
purpose of developing an economical proce
tetrachloride from domestic ilemite a
Under the program, smelting studies to p
be conducted at the Bureau's Northwest
ment Station at Albany, Oreg., and resea
ination of the titanium slag was to be don
laboratory.

The Defense Department awarded B
Columbus, Ohio, in March 1955, a $1 mi
titanium metallurgical laboratory.[4] Initi
was to concentrate on gathering and dis
providing technical advice to industry on
tion of titanium for military equipment.

[4] Wall Street Journal, Battelle Gets U. S. Contract for Researc
1955, p. 15.

operation of the laboratory for 18 to 24 months from the effective date of the agreement.

Experiments with a new process for producing titanium metal and a new method of obtaining titanium from impure scrap were conducted under two contracts signed by GSA in 1955.

One agreement (Contract DMP–113, dated May 17, 1955) was with National Research Corp. and Monsanto Chemical Co. Under it, National Research Corp. was to test a new fused-salt process for producing titanium at Cambridge, Mass., as previous work had reached the point where larger scale operations were necessary for complete evaluation of the new process. A pilot plant having a rated capacity of 1,000 pounds per day was to be operated. The work was estimated to cost about $1,183,500. The Government was to reimburse the firms, but they were to receive no fee for the work. The Government was to get nonexclusive, royalty-free licenses on the inventions and patents that might be developed. The contract contained provisions for repaying the Government's investment, should the process prove to be feasible and commercial production result within 10 years.

The second agreement (Contract DMP–114, dated April 29, 1955) was with Horizons, Inc., of Cleveland, Ohio. The company was to regenerate titanium from impure scrap metal by its patented process. Horizons, Inc., also was to work without fee. Cost of the experimental operations was estimated at $96,500, to be paid by the Government. However, should the work prove successful and the process be put into commercial production within 10 years, the Government was to be reimbursed for its investment and was to receive nonexclusive, royalty-free licenses on inventions and patents that might be developed.

The construction of a multimillion-dollar titanium tetrachloride plant at Natrium, W. Va., was announced by Columbia-Southern Chemical Corp., Pittsburgh, Pa., on April 14, 1955.[5] Initial output of titanium tetrachloride, the basic material consumed in manufacturing titanium metal, was scheduled for April 1956. A 5-year contract to supply titanium tetrachloride to Electro Metallurgical Co., Division of Union Carbide & Carbon Corp., at Ashtabula, Ohio, was announced by Columbia-Southern in May 1955.

Over half of the sponge produced domestically, plus a quantity of scrap, was melted to make 4,573 short tons of ingots. Of this quantity, 4,442 short tons of ingot was consumed to produce 1,898 short tons of mill products, including sheet, plate, strip, forging and extrusion billet, rod, bar, wire, and tubing. Mill products were produced by plants of the following companies: Harvey Machine Co., Torrance, Calif.; Mallory-Sharon Titanium Corp., Niles, Ohio; Rem-Cru Titanium, Inc., Midland, Pa.; Republic Steel Corp., Massillon and Canton, Ohio; and Titanium Metals Corporation of America, New York, N. Y.

In June Mallory-Sharon Titanium Corp. completed a new melting

[5] American Metal Market, Columbia-Southern To Build Large *Titanium Tetrachloride Plant*: Vol. 62, No. 73 Apr., 15, 1955, pp. 1, 3.

plant to triple its melting capacity.[6] ... furnaces increased the melting capacity to ... This same company purchased the Niles ... Sharon Steel in December, to integrate ... facilities.[7]

Rem-Cru Titanium, Inc., announced in S... group of 5 buildings and 10 acres of lan... Company of America, Midland, Pa., to exp... facilities.

Titanium Pigments.—Based on titanium ... production and shipments of titanium pig... and 22 percent, respectively, above the r... Titanium pigments were produced by the ... Pigments Division, at Gloucester City, N... Piney River, Va.; Glidden Co., Chemicals-... at Baltimore, Md.; E. I. du Pont de Nem... Moor, Del., and Baltimore, Md.; and t... St. Louis, Mo., and Sayreville, N. J.

E. I. du Pont de Nemours & Co., Inc., w... facturer to announce expansion plans durin... expand production of titanium dioxide 25 ... Del., plant by late 1956.[8]

Welding-Rod Coatings.—Production of tit... was 233,353 short tons in 1955, an increase o... duction. Of this quantity, 46 percent was ... 15 percent with manufactured titanium d... mixture of rutile and manufactured diox... ilmenite. A small quantity of titanium s... coatings.

CONSUMPTION AND

Concentrates.—Consumption of all three ... ilmenite, titanium-slag, and rutile—reach... Almost 99 percent of the 741,450 short tons ... used in producing manufactured titanium ... included some ilmenite, in the form of a ... was used to make titanium metal. Virtua... of titanium slag was consumed for pigm... ilmenite in this use. Of the 28,762 tons o... cent was used for titanium metal and 4... coatings; the remainder went into alloys a... miscellaneous uses.

[6] Light Metal Age, Mallory-Sharon Triples Titanium-Melting ... 1955, p. 31.
[7] Iron Age, Mallory-Sharon Integrates Melting, Rolling Facilitie...
[8] Oil Paint and Drug Reporter, Titanium Dioxide Pigments O... No. 10, Mar. 7, 1955, p. 4.

TABLE 3.—Consumption of titanium concentrates in the United States, 1946–50 (average) 1951–53 total, and 1954–55, by products, in short tons

Product	Ilmenite [1]		Titanium slag		Rutile	
	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content
1946–50 (average)	528,177	275,099			[r] 9,288	[r] 8,618
1951	713,303	273,037			17,227	16,018
1952	682,850	351,553	24,236	16,746	18,317	17,353
1953	687,075	354,470	73,528	52,511	20,170	19,033
1954						
Pigments (mfg. TiO_2) [2]	[r] 673,506	[r] 349,857	100,670	70,993		
Welding-rod coatings	845	501			8,817	8,109
Alloys and carbide	5,535	2,779			[r] 2,060	[r] 1,987
Ceramics	9	5			372	348
Miscellaneous	8	4	[4] 155	[4] 109	[r] [5] 9,405	[r] [5] 8,927
Total	[r] 679,903	[r] 353,146	100,825	71,102	20,063	19,431
1955						
Pigments (mfg. TiO_2) [2]	732,510	396,500	134,362	94,108		
Titanium metal [6]	[7]	[7]			10,337	9,821
Welding-rod coatings	1,188	689			12,614	11,848
Alloys and carbide	7,291	3,617			2,431	2,306
Ceramics	21	13			452	423
Miscellaneous	431	258	[4] 591	[4] 414	[8] 2,928	[8] 2,704
Total	741,450	401,146	134,953	94,522	28,762	27,192

[1] Includes a mixed product containing rutile, leucoxene, and altered ilmenite used to make pigments and metal.
[2] "Pigments" include all manufactured titanium dioxide.
[r] Revised figure.
[4] Includes consumption for welding-rod coatings and research purposes.
[5] Includes consumption for chemicals, metal, fiberglass, and welding flux.
[6] Not separately classified before 1955.
[7] Included with pigments to prevent disclosing individual company confidential data.
[8] Includes consumption for chemicals, fiberglass, and welding flux.

TABLE 4.—Distribution of titanium-pigment shipments, by industries, 1946–50 (average) and 1951–55, percent of total

Industry	1946–50 (average)	1951	1952	1953	1954	1955
Distribution by gross weight:						
Paints, varnishes, and lacquers	77.1	73.3	70.9	67.1	64.3	65.3
Paper	6.0	5.9	7.0	9.7	10.1	10.1
Floor coverings (linoleum and felt base)	3.9	4.4	5.0	4.8	4.5	4.6
Rubber	2.6	2.5	2.8	3.4	3.1	3.4
Coated fabrics and textiles (oilcloth, shadecloth, artificial leather, etc.)	1.8	1.5	2.1	2.0	2.4	2.7
Printing ink	.9	1.3	1.0	1.2	1.2	1.3
Other	7.7	11.1	11.2	11.8	14.4	12.6
Total	100.0	100.0	100.0	100.0	100.0	100.0
Distribution by titanium dioxide content:						
Paints, varnishes, and lacquers	70.1	64.9	62.9	58.8	55.4	58.4
Paper	8.5	8.9	10.4	14.1	14.1	13.5
Floor coverings (linoleum and felt base)	4.9	5.7	5.6	5.4	5.2	5.2
Rubber	3.5	3.4	3.0	4.5	4.0	4.4
Coated fabrics and textiles (oilcloth, shadecloth, artificial leather, etc.)	2.3	2.1	2.9	2.6	3.2	3.4
Printing ink	1.4	1.8	1.6	1.6	1.6	1.7
Other	9.3	13.2	13.0	13.0	16.5	13.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Metal.—Most titanium mill shapes
defense applications, especially military
The advantages to be gained by usin
engines were emphasized in an article.[9]
use of titanium in production of jet-engi
of 250 pounds of weight in certain engin
production airframe design achieved
300 pounds in fighters and up to 600
reductions were due to direct substitu
steel, and further weight savings were
were redesigned to use titanium.
It was disclosed that five major a
F–101A Voodoo were made of titanium,
panel, keel assembly, fairing assembly, f
mount trunnions.[10] Titanium was util
previously had required the use of stain
A new type of titanium shroud was
F–102A supersonic interceptor. The
the plane's J–57 engine from the surro
"rigidized" metal, which consists of ri
the sheet.[11]
As a result of using titanium in the
and FJ–3, titanium parts were also desi
of its high strength-to-weight ratio at
and low thermal conductivity, titanium
and fire seals of the FJ–4. Titanium m
section and a portion of the midsection
XF8U–1 jet-fighter plane made by Cha
The first sizable order for titanium b
placed by the Convair Division of Gener
1955. The order was for 360,000 shear
and costing $650,000.
The results of the evaluation of titan
piping material for the Navy were relea
was unaffected by 8 months of erosion
flowing through it at 20 feet per second.
Actual uses of titanium in nondefense
publicity in 1955. Pieces of equipment
tested in operating conditions proved f
ment made from conventional materi
instances. This superiority was due mai
of titanium metal to a wide variety of co
applications reported follow:
Titanium was used for the contact par
solid cakes from corrosive slurries of cal

[9] Metzger, Maj. Gen. Kern B., Strategic Uses of Titanium:
pp. 116–118
[10] Rem-Cru Titanium Review, Titanium Helps the Voodoo
pp. 1–2.
[11] Modern Metals, Rigidized Titanium Used in Jet-Engine S
[12] Schreitz, W. G., Evaluation of Titanium as a Salt-Wat
Rept. 040037D, August 1955, 6 pp.

steel used in the filter press developed severe pitting after 2 weeks of service, while titanium showed no sign of corrosion after 7 months of operation.[13]

The superiority of titanium to stainless steel in handling hot nitric acid in chemical-processing equipment was dramatically demonstrated. In one prototype application a titanium "top-hat" condenser insert, consisting of 70 tubes welded to a titanium sheet, was subjected to service in a condenser handling vapors of 60 percent nitric acid at 300 p. s. i. and 195° C. The insert was unaffected after 14 months of use, whereas similar ones of stainless steel lasted 4 to 6 months.[14]

Steam-jet diffusers that had to be replaced every 3 months when they were made of cast iron were made of titanium and showed no sign of corrosion after 2½ years of operation.[15] The steam-jet diffusers were used to create a process vacuum and were subject to corrosion by high-velocity steam and dilute hydrochloric acid.

It was revealed that titanium was an excellent material for fabricating parts of anodizing racks used in anodizing aluminum.[16] The titanium parts were unaffected by the corrosive solutions used in anodizing, and the racks did not have to be stripped after each cycle, thus saving time and manpower. It was also pointed out that racks made of titanium could also be used advantageously in many electroplating solutions.

The General Motors Corp. announced in late 1955 that it had built and successfully tested an experimental turbine-powered car, called the Firebird II, which had a body shell made completely of titanium.

Some potential uses of titanium fittings on sailing craft were pointed out.[17] On one 22-foot craft the mast fittings, jib-halyard fitting tangs, spreaders, a tiller-head fitting, and other parts were made of titanium. The corrosion resistance and light weight of titanium were two properties cited as making it a desirable material for use on pleasure and racing boats.

STOCKS

Year-end stocks of ilmenite, titanium slag, and rutile decreased 2, 21, and 7 percent, respectively, in 1955 from 1954. Consumers' stocks of rutile increased about 1,000 tons, so that the total decline in rutile stocks was due to a lowering of inventories of mines and distributors. At the 1955 rate of consumption, total stocks (on a titanium dioxide content basis) represented supply of 6½ months for rutile, 9½ months for ilmenite, and 6 months for titanium slag.

Stocks of titanium sponge metal held by sponge producers and melters at the end of 1955 were 854 short tons. This quantity of sponge would have represented a 2½-month supply for the melters at the 1955 rate of consumption.

[13] Rem-Cru Titanium Review, Pennsylvania Salt Unit Proves Titanium Equipment's Value for Handling Commercial Bleach: Vol. 3, No. 3, July 1955, pp. 1–2.
[14] Modern Metals, Titanium Withstands 60 Percent Nitric Acid for 14 Months: Vol. 11, No. 6, July 1955, pp. 95–96.
[15] Rem-Cru Titanium Review, Titanium Performs in Key Corrosion Spot for Du Pont: Vol. 3, No. 2, April 1955, p. 5.
[16] Rem-Cru Titanium Review, Titanium Proves Optimum Material for Anodizing Racks: Vol. 3, No. 1, January 1955, p. 7.
[17] Du Pont Magazine, Titanium Afloat: Vol. 49, No. 3, July 1955, pp. 34–35.

TABLE 5.—Stocks of titanium concentrates in 1954–55, in short

Stocks	Ilmenite	
	Gross weight	TiO_2 content
[1] 1954		
Mine	71,907	33,298
Distributors	715	426
Consumers	562,255	296,339
Total stocks	634,877	330,062
1955		
Mine	80,429	37,228
Distributors	407	242
Consumers	542,150	283,896
Total stocks	622,986	321,366

[1] Revised figures reflect inventory corrections reported by in

PRICES

Concentrates.—E&MJ Metal and M following nominal prices for ilmenite and Ilmenite, 59.5 percent TiO_2, f. o. b. Atl at $18 to $20 per gross ton (2,240 pound year to June 20, 1955, when the price remained the same to the end of the yea was listed at 7 to 7½ cents per pound a 7¼ to 7½ cents per pound on February pound on April 14, 1955; 9 to 9½ cents p 9 to 10 cents per pound on June 7, 1955; a depending on time of delivery, on Septen the year. Price quotations for titaniu metallurgical grade, were published in Reporter in December 1955 as follows:

Natural granular, bags, carlots, per short ton f. c
Niagara Falls, N. Y., carlots
5-ton lots, same basis
1-ton lots, same basis
(Milled rutile, $7.50 per ton higher.)

Manufactured Titanium Dioxide.—Mar titanium dioxide remained the same in 19 Price quotations on manufactured titan 1955, published in the Oil, Paint and Dru

Anatase, chalk-resistant, regular and ceramic, pound
Less than carlots, delivered, per pound
Rutile, nonchalking, bags, carlots, delivered East
Less than carlots, delivered East, per poun
Titanium pigment, calcium-rutile base, bags, pound
Less than carlots, delivered, per pound

Metal.—Price reductions for titanium-s the prices of titanium-mill products were metal industry in 1955. The price of tita

to use the best water obtainable for any and all uses. However, water of inferior quality may be used for certain purposes, conserving higher quality water for use where quality requirements are more exacting.

The impurities in various lakes and rivers used for water supplies were described in an article.[9] The list of soluble impurities included the following substances:

Cations: Ca, Mg, Na, K, Al, Fe, Mn, H.
Anions: HCO_3, SO_4, Cl, SiO_3, CO_3, F, S, OH.
Gases: CO_2, H_2S, CH_4.

A second article described in detail the main types of water-conditioning processes.[10] These included (1) sodium cation exchange, (2) hydrogen cation exchange, (3) ion-exchange demineralization using both cation and anion exchangers, (4) cold lime soda, (5) hot lime soda, (6) coagulation, settling and filtration, (7) aeration, (8) deaeration, and (9) iron and manganese removal.

The theory, operation, and equipment used in the disposal of organic waterborne wastes by the process known as bio-oxidation was described in a technical journal.[11] Both sewage and organic industrial wastes have been successfully treated by the activated sludge process wherein a portion of the biologically active sludge from a previous batch is thoroughly mixed with the incoming waste stream and aerated vigorously. Approximately 60 percent of the dissolved and colloidal organic matter in the waste stream goes into the growth of additional microorganisms or sludge, while 40 percent is oxidized to CO_2 and water to provide energy for the life process. The excess sludge is removed, leaving a sewage effluent from which 90-95 percent of the BOD (biological oxygen demand) has been removed.

The steady increase in demand for water together with the increased pollution and high cost of developing additional fresh water sources turned attention to sea water as an inexhaustible potential source of fresh water. The U. S. Department of the Interior, Office of Saline Water Conversion, has sponsored research and development of low-cost saline water conversion processes. The Saline Water Act of 1952 was amended in 1955,[12] increasing the scope of the program from 5 years to 11, with a limited extension for 3 additional years. Ten million dollars was authorized to be spent in this period, with $2½ million authorized in Federal scientific laboratories.

Twenty-five projects were in progress in 1955, involving processes of thermal distillation, solar distillation, electric membrane separation, osmotic processes, solvent extraction, separation by freezing, and other processes.[13]

Outstanding progress was reported in vapor-compression distillation and electro-osmotic membrane separation. A vapor compression unit of 25,000 gallons per day was in the development stage. An electric membrane process was also in the pilot-plant stage. As this type of process removes salt rather than water from brine, it is particularly applicable to waters of low salinity because of the reduced energy requirements.

[9] Nordell, Eskel, Water—What It Contains: Chem. Eng., vol. 62, No. 9, September 1955, pp. 183–188.
[10] Nordell, Eskel, Water—How It's Treated: Chem. Eng., vol. 62, No. 10, October 1955, pp. 178–184.
[11] Eckenfelder, W. W., and Moore, T. L., Bio-Oxidation: Chem. Eng., vol. 62, No. 9, September 1955, pp. 189–202.
[12] Public Law 111, 84th Cong., 1st sess.: Chap. 227, H. R. 2126, approved June 29, 1955.
[13] Secretary of the Interior, Saline Water Conversion: Annual Report, 1955, 82 pp.

Zinc

By O. M. Bishop,[1] A. J. Martin,[1] and

THE ZINC INDUSTRY participated in th
activity in the United States in 1955. P
tion of slab zinc reached alltime highs, and
able zinc increased moderately. An upwar
zinc, which began in March 1954, continued t
consumption coupled with sustained Goverr
National Stockpile reduced smelter stocks o
level since June 1952 despite an increase in
Consumers' stocks increased moderately.

Production of slab zinc increased 18 perce
1 million tons for the first time. Of the total
from domestic ore and 37 percent from for
redistilled secondary metal from scrap. Pign
directly from domestic and foreign ores conta
tons of additional primary metal, compared
in 1954.

Consumption of slab zinc, keeping pace w
industrial production, increased 27 percent to
Zinc used in zinc-base alloys, mostly for d
percent over 1954 largely owing to record aut
increased use of zinc die castings per car. S
nizing rose 12 percent owing to the 13-percent
public construction; galvanized products
process galvanized sheet found increased acc
furnished 79 percent of the slab zinc suppli
The zinc content of alloys, zinc dust, chemic
from zinc-bearing scrap increased 17 percent

Stocks of slab zinc at smelters dropped fr
beginning of the year to 39,300 tons at the en
consumers' plants increased from 103,700 tons

The price of Prime Western slab zinc, Ea
cents a pound at the beginning of the yea
13 cents on September 6, where it remain
Purchases for the National Stockpile helped
face of the continued excess of overall zinc s
demand although the quantity of zinc offered
declined as industrial demand improved durin

Domestic mine production, at 514,700 tons
9 percent more than in 1954 but 14 percent l
the 5-year period 1950–54. Some mines, clos
declining prices between June 1952 and Fe
reopened by the end of 1955; prolonged stri
Jersey caused the loss of much production du
from reopened mines and from two new mine
moderate production gain over 1954. New M
15,300 tons of recoverable zinc in 1955 comp

[1] Commodity specialist.
[2] Statistical assistant.

in 1954, recorded the largest gain, as 3 of the 6 large mines that had suspended work because of the low price of zinc resumed production. Of the 16 important producing States, only Idaho, Missouri, New Jersey, New York, and Oklahoma reported declines from 1954.

Output of secondary zinc, recovered chiefly from zinc- and copper-base scrap, increased 12 percent over 1954 to 305,000 tons, considerably more than half the quantity produced from domestic ores.

Imports of zinc contained in ore and concentrate increased 5 percent and those of slab zinc 25 percent; the 674,000 tons imported in both forms was 10 percent more than in 1954 but considerably below the 1953 alltime record of 748,000 tons. By far the largest quantity came from Mexico, Canada, and Peru. Exports of slab zinc totaled 18,000 tons.

Outside the United States, zinc demand and prices also increased in 1955. The rate of gain in total consumption in foreign countries was about half that in the United States alone, but mine production was nearly the same as in the United States. The principal countries gaining more than 10 percent over 1954 in mine output were Canada, Mexico, Italy, and French Morocco; the only substantial decreases were 21 percent in Belgian Congo and 11 percent in South-West Africa. Smelter output of zinc increased in all producing countries except Belgium and Australia.

TABLE 1.—Salient statistics of the zinc industry in the United States, 1946–50 (average) and 1951–55

	1946–50 (average)	1951	1952	1953	1954	1955
Production of slab zinc:						
By sources:						
From domestic ores.....short tons..	537,395	621,826	575,828	495,436	380,312	582,918
From foreign ores.....do....	257,959	259,807	328,051	420,669	422,113	380,591
Total primary.....do....	795,354	881,633	904,479	916,105	802,425	963,509
From scrap.....do....	57,678	48,657	55,111	52,875	68,013	66,042
Total production.....do....	853,032	930,290	959,590	968,980	870,438	1,029,548
Stocks on hand at producers' plants:						
At primary plants.....short tons..	72,079	21,343	81,344	176,725	[1] 121,847	87,322
At secondary plants.....do....	1,695	637	3,677	3,268	1,549	1,936
Total.....do....	73,774	21,980	85,021	179,993	[1] 123,396	89,260
Imports (general):						478,044
Ores (zinc content).....do....	269,535	302,777	449,636	513,724	[1] 455,427	
Slab zinc.....do....	110,647	88,043	115,703	234,576	156,858	195,609
Mine production of recoverable zinc...do....	611,799	681,189	666,001	547,430	473,471	514,671
Consumption:						
Slab zinc.....do....	816,862	933,971	852,783	935,027	884,299	1,119,812
Ores (recoverable zinc content)...do....	127,029	133,845	109,277	118,244	99,247	108,393
Zinc-base scrap [2] (recoverable zinc content).....short tons..	87,624	91,808	72,435	73,936	62,166	74,847
Copper-base scrap (recoverable zinc content).....short tons..	143,026	165,403	175,937	160,499	132,051	149,630
Aluminum-and magnesium-base scrap (recoverable zinc content) short tons..	705	1,055	1,216	3,783	2,929	6,966
Total.....do....	1,176,236	1,326,082	1,211,648	1,342,389	1,180,692	1,459,248
Exports:						
Slab zinc.....do....	58,211	36,510	57,714	17,909	24,994	17,000
Price, Prime Western grade:						
East St. Louis.....cents per pound..	11.77	17.99	16.21	10.86	10.69	12.85
London.....do....	12.80	21.46	18.53	9.47	9.78	11.96
World mine production.....short tons..	2,050,000	[1] 2,600,000	[1] 2,870,000	[1] 2,980,000	[1] 2,960,000	3,200,000
World smelter production.....do....	1,880,000	[1] 2,360,000	[1] 2,470,000	[1] 2,640,000	[1] 2,710,000	2,990,000

[1] Revised figure.
[2] Excludes redistilled slab and by remelting.

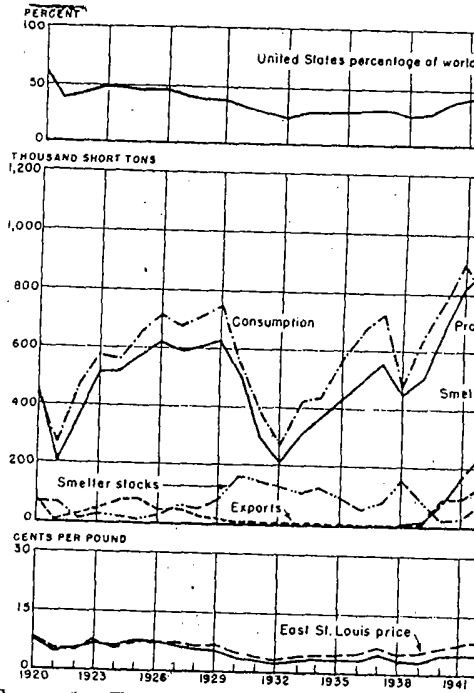

FIGURE 1.—Trends in the zinc industry in the U sumption figures represent primary slab zinc p made directly from ore.

GOVERNMENT REGUL

Legislation extending the Reciprocal T another 3 years was signed by President E The law gave the President authority to 5 percent a year in each of the 3 years and al adverse effects to petition for an increase. not changed during the year.

The Defense Production Act of 1950 with to June 30, 1956.

The Export Control Act of 1949, still i licenses for exports to all countries except C

Defense Mobilization Order OD–LS 416, closed expansion goals and hence the issuan sity for a number of minerals, including lea

DEFENSE MINERALS EXPLORATION

The DMEA program to encourage expl critical minerals and metals was continue exploration contracts for lead and zinc, the percent of the approved cost of projects.

tracts made in 1955 was 23, authorizing a maximum Government participation of $691,972, matched by an equal amount of private capital for an anticipated expenditure of $1,383,944, an average of $60,172 per project. From the beginning of the program in 1951 through December 1955, 220 contracts involving lead and zinc were executed, which authorized Government participation of $9,719,243 [2] and total expenditures (combined Government and private capital) of $19,445,191. Lead-zinc and lead-zinc-copper exploration contracts in 1955 furnished 15 percent of all DMEA contracts executed and

TABLE 2.—Defense Minerals Exploration Administration contracts involving lead and zinc, by States, executed in 1955

State and contractor	Property	County	Date approved	Total amount [1]
CALIFORNIA				
Shasta Copper & Uranium Co., Inc.	Shasta King	Shasta	May 24, 1955	$104,572
COLORADO				
Buckskin Joe Mines, Ltd.	Gold Ridge-Denver-France claims.	Park	Jan. 3, 1955	44,875
Hurst Majors	Mineral Farm group	Ouray	Sept. 21, 1955	2,200
IDAHO				
Copper Mountain Mine	Copper Mountain	Butte	Oct. 13, 1955	14,250
Highland Surprise Consolidated Mining Co.	Deer Trail	Custer	June 17, 1955	59,570
Idaho Consolidated Mines, Inc.	Twin Peak	Lemhi	Nov. 10, 1955	17,370
Shirts, Fred H. and Earl W.	Mountain King mine	Custer	Oct. 8, 1954	31,304
Sunset Mines, Inc.	Liberal King	Shoshone	Nov. 22, 1954	101,125
MISSOURI				
McLaren, Lucy A.	McLaren, Lucy A.	St. Francois	Dec. 23, 1954	7,050
MONTANA				
Boss Mines, Inc.	Boss & Atlantus	Cascade	Dec. 7, 1954	24,140
Elkhorn Consolidated, Inc.	Dunstone mine	Jefferson	Nov. 22, 1954	26,110
Hogan, Howard R. and Pohl, E.	Silver Saddle	Broadwater	June 6, 1955	16,460
NEVADA				
Combined Metals Reduction Co.	Black Prince	Lincoln	Mar. 2, 1955	98,200
Mt. Wheeler Mines, Inc.	Mount Wheeler	White Pine	Mar. 15, 1955	303,200
Nelson, A. O., et al.	Four Aces	Esmeralda	Mar. 30, 1955	8,436
Ogle Swingle	Leadville mining claims	Washoe	June 21, 1955	15,300
Yuba Dike Mines, Inc.	Yuba Dike	Lincoln	May 17, 1955	21,750
NEW MEXICO				
Western Development Co.	Bottom Dollar—Black Hornet Teresa.	Santa Fe	Sept. 29, 1955	16,710
UTAH				
McFarland & Hullinger	Ophir	Tooele	Sept. 15, 1955	104,700
U. S. Smelting, Refining & Mining Co.	United States and Lark mine.	Salt Lake	Aug. 15, 1955	301,930
VIRGINIA				
Bellville Gold Mines, Ltd.	Dillwyn area	Buckingham	Jan. 6, 1955	25,500
Do.	New Canton area	do.	Dec. 13, 1954	14,340
WISCONSIN				
Gille, Paul	Lindsay and Dawson Lease.	Lafayette	Jan. 6, 1955	24,845
Total				1,383,944

[1] Government participation was 50 percent in exploration projects for lead and zinc in 1955.

[2] Includes sums provided through amendments to contracts and also funds for participation in exploration contracts, which were subsequently canceled or terminated upon completion.

20 percent of all Government funds obliga
through 1955, these contracts furnished 2
and 40 percent of the Government funds ol

GENERAL SERVICES ADMINI

The General Services Administration (
procurement and administration, procu
programs (as agent of the former Foreign
and the new International Cooperation Ad
istration of Defense Production Act prog
purchase programs. Purchases of zinc pr
mined ores were made against the long-t
each month of 1955, but the quantity te
after March. The program for the bart
commodities in exchange for strategic and
to the provisions of the Agricultural Trade
ance Act of July 1954, was carried on wi
materials, but no zinc was acquired under
No new contracts with foreign producers fo
Defense Production Act of 1950 were exe
produced under contracts negotiated in pre

DOMESTIC PRODUCT

Statistics on zinc production are compile
smelter basis. Zinc content of ore and co
justed to account for average smelting lo
domestic zinc output from year to year.
zinc from domestic ores represents an acc
recovery but differs from the mine-recovery
lag between mine or mill shipments and s
cause considerable zinc ore and concentr
utilized directly in making zinc pigments a
zinc recovered at smelters treating zinc-be
tuted a large part of the domestic produc

Zinc-production data for 1954 were c
Bureau of the Census (U. S. Department of
of final data reported by each agency sho
The Bureau of Mines figure (473,471 short
able domestic mine production of zinc in 19
the Census figure (455,740 tons). The di
broader coverage by the Bureau of Mines t
of metal contained in old slag and mill
mines with production valued at less than
reported by the two agencies also differ b
from ores transported across State lines fo
the Bureau of Mines to the production of
was mined, while the Bureau of the Census
to the State in which the ore was milled.

MINE PRODUCTION

Domestic mine production of recoverable
in 1955 from 473,500 tons in 1954 but wa

average of the 5 years 1949–53. Some mines that had shut down because of low zinc prices prevailing since the latter part of 1952 resumed production in 1955. Two important newly developed mines—at Crested Butte, Colo., and at Friends Station, Tenn.—began producing ore during the year. The production gain from these sources was partly offset by losses resulting from strikes, particularly those of unusually long duration at some mines in the Coeur d'Alene region of Idaho and one mine each in Montana and New Jersey.

The producing zinc mines of the United States were widely dispersed in 50 mining districts in 7 areas—the Tri-State area of Southeastern Kansas, Southwestern Missouri, and Northeastern Oklahoma; Tennessee-Virginia; Sussex County, N. J.; St. Lawrence County, N. Y.; Northern Illinois and Wisconsin; Southern Illinois and Kentucky; and the Western States (in order of 1955 output—Montana, Idaho, Utah, Colorado, Washington, Arizona, New Mexico, California and Nevada).

The Western States output of recoverable zinc, at 277,800 tons, was 17 percent larger than in 1954, despite a strike which closed 15 mines in Idaho and 1 in Montana from August 23, 1955, to January 31, 1956.

Idaho output in 1955 dropped 13 percent to 53,300 tons, the smallest quantity since 1939. Important zinc producers affected by the strike, all in the Coeur d'Alene region, Shoshone County, included the Frisco, Page, Tamarack, and Sidney mines. The Star mine, active throughout the entire year, continued to be the leading zinc producer in the State; other important producers included the Bunker Hill mine and Morning mine salvage. The only substantial Idaho producer outside the Coeur d'Alene region was the Triumph mine in Blaine County.

Montana was the leading State in mine production of zinc in 1955, but its output (13 percent more than 1954) was well under that in 1951–53. Most zinc in the State was mined at Butte, Silver Bow County, by Anaconda Co.; Anselmo, Lexington, and Orphan Girl lead-zinc mines and the Emma manganese-zinc mine supplied most of the production. Output from the Jack Waite mine on the Montana-Idaho State line in Sanders County, Mont., decreased as this mine was among those of the Coeur d'Alene region that were closed by the prolonged strike.

Production of recoverable zinc in Utah increased 9,500 tons (28 percent) to 43,600 tons in 1955. The gain resulted mainly from the full year of Park City mines production, and from increased output at the United States and Lark mines. Output from other mines varied only slightly from 1954.

Colorado zinc production increased slightly (200 tons) over 1954. Some zinc production was lost through destruction by fire of the Emperius Mining Co. mill at Creede in August. The newly developed Kaystone zinc-lead mine of American Smelting & Refining Co. at Crested Butte began producing in June. The Eagle mine (New Jersey Zinc Co.) at Gilman was by far the leading zinc producer in the State; Idarado mine in San Miguel County ranked second. Other important producers included the Rico-Argentine mine at Rico, Camp Bird (King Lease) near Ouray, Resurrection Mining Co. properties at Leadville, and Wellington mine at Breckenridge.

In Washington, mine output of zinc in
each of the four mines supplying nearly
State increased production. The Van S
as the leading producer, followed by th
and Grandview underground mines. C
dominately zinc producers and 1, the P
mately equal tonnages of zinc and lead.

Mine production of zinc in Arizona in
Important producers included the Iron K
Flux in Santa Cruz County, Athletic in
in Pima County, and Shannon in Cochis

In New Mexico, output of recoverable
compared with only 6 tons (all recove
Zinc and zinc-lead mining, which had st
cause of low zinc prices, was resumed in
Hog mine of American Smelting & Refi
trict, Grant County. In the latter part o
and mill (New Jersey Zinc Co.) and the
(Peru Mining Co.) also were reopened.

Zinc production in California rose to 6,
1954. The increase was due mainly to
conda Co. of its Darwin mine group, In
most of 1954.

Nevada production of recoverable zi
compared with the 5-year annual average
The low production was due mainly to
Metals Reduction Co. of the milling of le
ore, containing lead and zinc, at Pioche.
was contained in zinc ore drawn from a st
to smelter-fuming plants outside Nevada.

In the West Central States—Kansas,
mine production of zinc increased 9 percen
had no mine output of zinc since 1952.

The Tri-State or Joplin district produced
zinc and 19,700 tons of lead from 4,140,30
an additional 1,400 tons of zinc was recove
The mines and the Central and Bird Dog
leading producer in the district, ran contin
days in July, when union workers were on
company mines in the Oklahoma and Kans
Central mill treated custom ore from man
homa mines. The Barbara J. and Lawye
Nellie B. Division, American Zinc, Lead
steadily until December 22, when they we
Barbara J. mill resumed reduced product
The Ballard mill of National Lead Co. op
compared with only 8 months in 1954. S
old tailings in Oklahoma.

In Southeastern Missouri zinc concentr
byproduct from lead ores at some mills of S

In the States east of the Mississippi Rive
zinc decreased 3 percent from 1954. The
September 30, 1954, of the famous Franklin

TABLE 3.—Mine production of recoverable zinc in the United States, 1946–50 (average) and 1951–55, by States, in short tons

State	1946–50 (average)	1951	1952	1953	1954	1955
Western States and Alaska:						
Alaska	11	1				
Arizona	55,785	52,990	47,143	27,530	21,461	22,684
California	6,475	9,602	9,410	5,358	1,415	6,836
Colorado	42,707	55,714	53,203	37,809	35,150	35,350
Idaho	61,058	76,121	74,317	72,153	61,528	53,314
Montana	48,683	85,551	82,185	80,271	60,952	68,588
Nevada	20,301	17,443	15,367	5,812	1,035	2,670
New Mexico	36,063	45,419	50,975	13,373	6	15,277
Oregon	6	3	1			
South Dakota	10					
Texas	13	24	3			
Utah	37,101	34,317	32,947	20,184	34,031	43,556
Washington	12,663	18,189	20,102	32,780	22,304	29,536
Total	342,026	307,383	385,652	304,276	237,882	277,811
West Central States:						
Arkansas	29	50	26			
Kansas	36,277	28,004	25,482	15,515	10,110	27,611
Missouri	11,074	11,476	13,986	9,081	5,210	4,476
Oklahoma	51,041	53,460	54,916	33,413	43,171	41,543
Total	99,321	93,880	94,410	58,909	67,491	73,630
States east of the Mississippi River:						
Illinois	15,308	21,776	18,816	14,556	14,427	21,700
Kentucky	625	3,457	3,280	489	468	
New Jersey	64,734	62,917	59,190	45,700	37,416	11,643
New York	35,498	40,051	32,036	51,529	53,199	53,016
Tennessee	30,093	38,639	38,020	38,465	30,320	40,216
Virginia	15,028	7,332	13,409	16,670	10,738	18,329
Wisconsin	9,076	15,754	20,588	16,830	15,534	18,326
Total	170,452	189,926	185,939	184,245	168,098	163,230
Grand total	611,799	681,189	666,001	547,430	473,471	514,671

and the strike, which closed the Sterling mine at Ogdensburg from August 23, 1955, to the end of the year caused a 69-percent decline in New Jersey production. New York output decreased slightly. These declines were offset to a large extent by increases of 50 percent in Illinois, 33 percent in Tennessee, 10 percent in Virginia, and 18 percent in Wisconsin. New York was the principal zinc-producing State east of the Mississippi River; Tennessee ranked second.

The Balmat and Edwards mines of St. Joseph Lead Co., St. Lawrence County, N. Y., produced continuously in 1955. In New Jersey, at the Sterling mine of New Jersey Zinc Co., a new 2,700-foot shaft was completed, the expanded mine-development program was continued, and new crushing, ore-conveying, and other improved facilities were installed.[4]

In Tennessee six zinc mines, all in the Mascot-Jefferson City area, Knox and Jefferson Counties, produced during 1955. American Zinc Co. of Tennessee ran its Mascot No. 2, Grasselli, Athletic, and North Friends Station mines (also productive in other recent years); at the end of July, it began producing ore from the newly developed Young mine. The other producer in the Jefferson City area was the Davis-Bible mine of the Tennessee Coal & Iron Division, United States Steel Corp. At the new Jefferson City mine of New Jersey Zinc Co. (scheduled to reach full production in 1956) underground development

[4] Mining Engineering, New Jersey Zinc Rejuvenates Sterling Zinc Producer: Vol. 7, No. 5, May 1955, pp. 442–443.

was continued, ore hoisting and ventilating and a 1,000-ton flotation mill and other surfa construction. The company also began de property at Treadwell, 25 miles from the Jef Tennessee Copper Co. mines in Polk Coun yielding copper, zinc concentrates, and pyrite

In Virginia the New Jersey Zinc Co. Austi tration mill in Wythe County, producing continued a 13,300-foot transportation drift mine with the Austinville workings; ore produc mine will be treated in the Austinville mill.

In Illinois and Wisconsin the mines and Inc., and Eagle-Picher Co. near Galena in Il Co. mine and mill in the Schullsburg district were large producers. In August, Vinegar H major producer in Wisconsin, sold its 800-ton and equipment to American Zinc, Lead & Sme the properties the remainder of the year. quired leases from Cuba City Mining Co. o and Temperly properties) in Wisconsin and a ment work would begin immediately and th expected by mid-1956. In Southern Illinois, centrate increased at the fluorspar-zinc-lead m Co. and Minerva Oil Co.

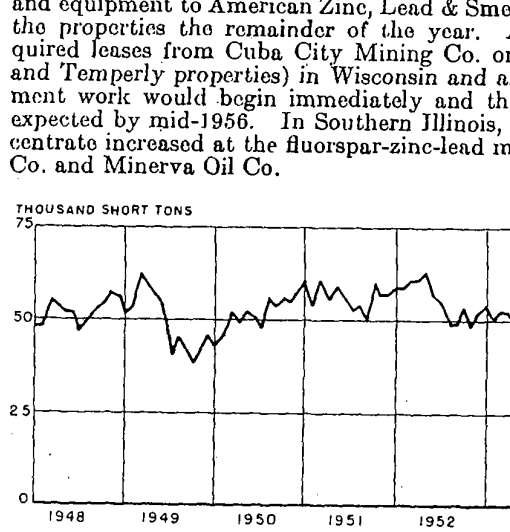

FIGURE 2.—Mine production of recoverable zinc in the months, in short tons.

TABLE 4.—Mine production of recoverable zinc in the months, in short tons

Month	1954	1955	Mon
January	40,148	41,005	August
February	39,508	40,101	September
March	42,706	46,286	October
April	40,357	43,721	November
May	40,510	45,351	December
June	40,930	43,972	
July	39,028	41,854	Total

[1] Includes Alaska.

TABLE 5.—Twenty-five leading zinc-producing mines [1] in the United States in 1955, in order of output

Rank	Mine	District	State	Operator	Type of ore.
1	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Co.	Lead-zinc.
2	Balmat	St. Lawrence County	New York	St. Joseph Lead Co.	Do.
3	United States and Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Do.
4	Eagle	Red Cliff (Battle Mountain)	Colorado	New Jersey Zinc Co.	Zinc.
5	Austinville	Austinville	Virginia	do.	Lead-zinc.
(2)	Ground Hog	Central	New Mexico	American Smelting & Refining Co.	Do.
(2)	Van Stone	Northport	Washington	do.	Do.
(2)	Mascot No. 2	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Zinc.
(2)	Star	Hunter	Idaho	Sullivan Mining Co.	Do.
(2)	Davis-Bible group	Eastern Tennessee	Tennessee	United States Steel Corp., Tennessee Coal & Iron Division.	Do.
11	Sterling	New Jersey	New Jersey	New Jersey Zinc Co.	Do.
12	Iron King	Big Bug	Arizona	Shattuck Denn Mining Co.	Lead-zinc.
13	Edwards	St. Lawrence County	New York	St. Joseph Lead Co.	Zinc.
14	Shullsburg	Wisconsin	Wisconsin	Eagle-Picher Co.	Do.
15	Bunker Hill	Yreka	Idaho	Bunker Hill Co.	Lead, lead-zinc.
16	Gray	Northern Illinois	Illinois	Tri-State Zinc Co., Inc.	Lead-zinc.
17	Barbara J.	Tri-State	Oklahoma	American Zinc, Lead Smelting Co.	Zinc.
18	Pend Oreille	Metaline	Washington	Pend Oreille Mines & Metals Co.	Lead-zinc.
19	Ontario-Park Utah	Park City region	Utah	United Park City Mines Co.	Do.
20	Darwin Group	Coso	California	Anaconda Co.	Do.
21	Treasury Tunnel-Black Bear	Upper San Miguel	Colorado	Idarado Mining Co.	Copper-lead-zinc.
22	Deardorff	Southern Illinois	Illinois	Ozark Mahoning Co.	Fluorspar-lead-zinc.
23	Page	Yreka	Idaho	American Smelting & Refining Co.	Lead-zinc.
24	Lawyers	Tri-State	Oklahoma	American Zinc, Lead Smelting Co.	Zinc.
25	Graham and Snyder	Northern Illinois	Illinois	Eagle-Picher Co.	Do.

[1] Excludes old slag dump of Bunker Hill Co. at Kellogg, Idaho. [2] Not listed in order of rank.

In the United States in 1955, the 25 lea
listed in table 5, yielded 68 percent of the
3 leading mines, 25 percent; and the 10 lea

TABLE 6.—Mine production of zinc in the princip
1946-50 (average) and 1951-55, in terms of r

District	State	1946-50 (average)
Tri-State (Joplin region)	Kansas, Southwestern Missouri, Oklahoma.	98,480
Summit Valley (Butte)	Montana	42,388
St. Lawrence County	New York	35,498
Coeur d'Alene	Idaho	78,191
Eastern Tennessee [2]	Tennessee	30,093
Upper Mississippi Valley	Northern Illinois, Iowa,[3] Wisconsin.	18,824
West Mountain (Bingham)	Utah	17,709
Red Cliff (Battle Mt.)	Colorado	17,515
Austinville	Virginia	15,027
Central	New Mexico	31,769
Park City region	Utah	9,187
New Jersey	New Jersey	64,734
Big Bug	Arizona	7,054
Kentucky-Southern Illinois	Kentucky, Southern Illinois.	6,275
Upper San Miguel	Colorado	4,480
Smelter (Lewis and Clark County).	Montana	2,596
Tintic	Utah	4,685
Cochise	Arizona	2,330
Smelter (Salt Lake County)	Utah	26
Warm Springs	Idaho	1,874
California (Leadville)	Colorado	6,076
Aravaipa	Arizona	595
Rush Valley and Smelter (Tooele County).	Utah	3,793
Flint Creek	Montana	55
Pima (Sierritas, Papago, Twin Buttes).	Arizona	5,482
Creede	Colorado	328
Yellow Pine (Goodsprings)	Nevada	609
Breckenridge	Colorado	670
Eureka (Bagdad)	Arizona	1,337
Patagonia (Duquesne)	do.	484
Animas	Colorado	1,128
Magdalena	New Mexico	3,457
Heddleston	Montana	1,471
Tomichi	Colorado	1,305
Cow Creek (Ingot)	California	
Chelan Lake [4]	Washington	2,235
Coso [4]	California	3,051
Elk Mountain [4]	Colorado	16
Harshaw [4]	Arizona	2,630
Metaline [4]	Washington	8,190
Northport [4]	do.	2,113
Pioche [4]	Nevada	17,409
Pioneer (Rico)[4]	Colorado	2,553
Silver Bell [4]	Arizona	48
Sneffels [4]	Colorado	702
Old Hat (Oracle)	Arizona	4,261
Pioneer (Superior)	do.	519
Verde (Jerome)	do.	2,522
Warren (Bisbee)	do.	27,738

[1] Districts producing 1,000 short tons or more in any year of th
[2] Includes zinc recovered from copper-zinc-pyrite ore in Polk C
[3] No production in Iowa since 1917.
[4] Figure withheld to avoid disclosing individual company conf
[5] This district not listed in order of 1955 output.

SMELTER PRODUCTION

Seventeen domestic primary zinc-reduction plants continued producing slab zinc mostly at capacity rates throughout 1955. In the third quarter of the year a new electrothermic zinc-slag furnace produced primary slab zinc directly from lead slags at the Herculaneum, Mo., lead smelter. The unit replaced a smaller one which had been used experimentally in previous years. Eight of the other 17 reduction plants used horizontal retorts exclusively, 4 used continuous smelting vertical retorts exclusively (1 plant wholly electrothermic and 1 partly so), and 5 employed the electrolytic-zinc process. The retort furnaces of American Zinc Co. of Illinois Fairmont City plant at East St. Louis remained idle, but the roasting and sintering units, cadmium plant, and sulfuric-acid plant were active.

Horizontal-Retort Plants.—Retorts at active horizontal-retort primary plants in 1955 numbered 54,576, compared with 54,496 in 1954. Of the total retorts, 46,468 (85 percent) were in use at the end of 1955, compared with 34,488 (63 percent) at the close of 1954. No substantial expansion of retort-smelting-plant capacity was reported during the year. The smelting companies continued their progressive practice of adding new facilities to meet changes in quality requirements in consuming industries, to obtain increased efficiency, better metallurgy, and lower costs. At the Blackwell, Okla., plant of Blackwell Zinc Co. (subsidiary of American Metal Co., Ltd.), the largest horizontal-retort smelter and melting and casting facilities were added to produce uniform metal of specified composition, and improvements in smelting practice enabled the plant to produce slab zinc of reduced lead content, when desired.[5]

Vertical-Retort Plants.—During 1955 three of the vertical-retort continuous distilling plants used New Jersey Zinc Co. externally gas fired vertical retorts; the fourth used the St. Joseph Lead Co. electrothermically heated vertical retorts. In the latter vertical retort and in the St. Joseph Lead Co. new electrothermic zinc-slag furnace at the Herculaneum lead smelter, the charge forms the resistance. One of the retorts used by New Jersey Zinc Co. plant, Palmerton, Pa., was a Sterling arc-type electric furnace, first used experimentally in 1951. Vertical retort of all types, at the end of 1955 numbered 91; 81 were in use at the end of the year.

Electrolytic Plants.—Five electrolytic zinc-reduction plants with a total of 3,720 electrolytic cells were producing in 1955; 3,492 cells were in use at the end of the year. Of 3,720 cells, in 1954, 3,317 were in use at the end of the year.

Smelting Capacity.—Owing to changes in metallurgical practice in the various plants, statistics on domestic smelting capacity vary from year to year, irrespective of additions or subtractions of smelter-recovery units. The active zinc-reduction plants in the United States, as of the end of 1955, had an annual capacity of 1,164,000 short tons of slab zinc. Smelter output was 88 percent of capacity. In 1954 smelter production was 76 percent of the reported capacity (1,150,600 tons). Horizontal- and vertical-retort primary plants produced 89 percent of the 669,400-ton reported capacity (78 percent of a 668,700-ton reported capacity in 1954), electrolytic plants at 89 percent of a 436,100-ton reported capacity (73 capacity in 1954), and secondary smelters a ton reported capacity (64 percent of a 56,4(

Waelz Kilns.—In 1955 Waelz kilns were a following places:

Illinois:
Fairmont City—American Zinc Co. of Illinois.[6]
LaSalle—Matthiessen & Hegeler Zinc Co.
Kansas: Cherryvale—National Zinc Co., Inc.[7]
Oklahoma: Henryetta—Eagle-Picher Co.
Pennsylvania:
Donora—American Steel & Wire Division of U
Palmerton—New Jersey Zinc Co.

Slag-Fuming Plants.—The following slag-impure zinc oxide, which was further treated

California: Selby—American Smelting & Refining C
Idaho: Kellogg—Bunker Hill & Sullivan Mining &
Montana: East Helena—The Anaconda Co.
Texas: El Paso—American Smelting & Refining Co.
Utah: Tooele—International Smelting & Refining C

During 1955 these 5 plants, treating 753,3 slag, produced 125,400 tons of oxide fume c recoverable zinc. Corresponding figures f 116,800, and 80,600 tons, respectively.

Active Zinc-Reduction Plants.—All but tw producing primary-slab zinc in 1955 incre Facilities for raising the capacity of some pla stage or being installed. According to the can Smelting & Refining Co., the capacity f High-Grade zinc from densified zinc oxide Corpus Christi, Tex., electrolytic plant wa this expansion, scheduled for completion in 1 a total capacity of approximately 100,000 t High-Grade zinc. Late in 1955, plans for e the annual capacity of the Sullivan electrolyt Idaho, were announced. Full control of the Bunker Hill & Sullivan Mining & Concentr exchange of stock with Hecla Mining Co. A report of New Jersey Zinc Co., the Palmert on a reduced basis at the beginning of 1955; b facilities were at capacity; and during the y increased 21 percent over 1954. Output of French process zinc oxide rose 18 percent. mechanical oxide furnaces readily produced tonnage of American process zinc oxide. Th St. Joseph Lead Co., on a full-time basis thr its output of slab-zinc equivalent of oxide a Other plants recording large increases in slab-the horizontal-retort smelters at Fort Smith, Amarillo, Tex.; and the electrolytic plants at Anaconda and Great Falls, Mont.

[5] American Metal Co., Ltd., Annual Report for the 68th Year: 1955.

[6] Plant idle entire year.
[7] See footnote 6.

Zinc-reduction plants in the United States in 1955 are listed as follows:

Primary Zinc Distillers

Horizontal-retort plants

Arkansas: Fort Smith—Athletic Mining & Smelting Co.
Illinois:
Fairmont City—American Zinc Co. of Illinois.[8]
LaSalle—Matthiessen & Hegeler Zinc Co.
Oklahoma:
Bartlesville—National Zinc Co., Inc.
Blackwell—Blackwell Zinc Co.
Henryetta—Eagle-Picher Co.
Pennsylvania: Donora—American Steel & Wire Div. of the United States Steel Corp.
Texas:
Amarillo—American Smelting & Refining Co.
Dumas—American Zinc Co. of Illinois.

Vertical-retort plants

Illinois: Depue—The New Jersey Zinc Co.
Pennsylvania:
Josephtown—St. Joseph Lead Co.
Palmerton—The New Jersey Zinc Co. of Pennsylvania.
West Virginia: Meadowbrook—Matthiessen & Hegeler Zinc Co.

Electrolytic plants

Idaho: Kellogg—Sullivan Mining Co.
Illinois: Monsanto—American Zinc Co. of Illinois.
Montana:
Anaconda—The Anaconda Co.
Great Falls—The Anaconda Co.
Texas: Corpus Christi—American Smelting & Refining Co.

Secondary Zinc Smelters.—Zinc-base scrap, which includes skimmings and drosses, die-cast alloys, old zinc, engravers' plates, new clippings, and chemical residues, was chiefly smelted at 11 secondary smelters.

Primary and secondary smelting, based on zinc-base scrap, produced 66,000 tons of redistilled zinc, 5,000 tons of remelt zinc, and 30,100 tons of zinc dust.

In addition to the secondary zinc and zinc products recovered from zinc-base scrap at primary and secondary smelters and other plants, 149,600 tons of zinc was recovered from copper-base scrap, chiefly in the form of brass and bronze. Additional details on the secondary zinc phase of the industry may be obtained in the Secondary Metals—Nonferrous chapter of this volume.

Secondary Zinc Distillers

Alabama: Fairfield—W. J. Bullock, Inc
California:
Los Angeles—American Smelting & Refining Co., Federated Metals Division.
Torrance—Pacific Smelting Co.

[8] Roasting and sintering, cadmium, and germanium units operated; furnaces idle entire year, and therefore no slab zinc was produced.

Illinois:
Beckemeyer—American Smelting & Refining
Hillsboro—American Zinc, Lead & Smelting
Sandoval—Sandoval Zinc Co.
New Jersey: Trenton—American Smelting & Re
Division.
New York: Tottenville—Nassau Smelting & Refi
Oklahoma: Sand Springs—American Smelting &
Division.
Pennsylvania:
Bristol—Superior Zinc Corp.
Mars—Beal Brothers.[9]
Philadelphia—General Smelting Co.
West Virginia: Wheeling—Wheeling Steel Corp.

SLAB ZINC

Primary slab-zinc output in 1955 reach
compared with 802,000 tons in 1954 and th
tons in 1943. Tonnage derived from dome
cent; that from foreign ores declined 10 pe

Production of redistilled slab zinc decre
tons; the quantity redistilled at secondary
cent, but that redistilled at primary smel
Primary smelters supplied 37 percent of th
dition to primary distilled zinc and redisti
tons of remelted secondary slab zinc was
purchased scrap (4,500 tons in 1954). Zi
large consumers of slab zinc recovered lar
from "runaround" scrap generated in their

Sixty percent of primary slab zinc was di
produced electrolytically. Output of Spe
percent over 1954 and that of High Grade
combined output of Intermediate, Brass Sp
47 percent, and that of Prime Western, 3
constituted 39 percent of the total in 1955 (
Special High Grade, 37 percent (31 percent
percent (15); Brass Special, 8 percent (6 per
than 2 percent (2); and Select, less than 1 p

TABLE 7.—Primary and redistilled secondary slab
States, 1946–50 (average) and 1951–

Year	Primary	
	From domestic ores	From foreign ores
1946–50 (average)	537,395	[1] 257,959
1951	621,826	259,807
1952	676,828	[1] 328,651
1953	[1] 496,136	[1] 420,669
1954	[1] 380,312	[1] 422,113
1955	582,913	[1] 380,691

[1] Includes a small tonnage of slab zinc further refined into high-g

[9] Plant closed in October 1955.

TABLE 8.—Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1946–50 (average) and 1951–55, in short tons

CLASSIFIED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled	Redistilled secondary [1]		Total
			At primary smelters	At secondary smelters	
1946–50 (average)	311,506	483,848	23,953	33,725	853,032
1951	336,087	545,646	16,251	32,406	930,290
1952	351,100	553,373	18,861	36,256	959,590
1953	370,870	545,235	17,645	35,230	968,980
1954	311,237	491,188	31,658	36,355	870,438
1955	389,891	573,613	24,747	41,295	1,029,546

CLASSIFIED ACCORDING TO GRADE

Year	Grade A		Grade B (Intermediate)	Grades C and D		Grade E (Prime Western)	Total
	Special High Grade (99.99% Zn)	High Grade (Ordinary)		Brass Special	Select		
1946–50 (average)	246,212	193,201	30,216	57,093	7,570	319,740	853,032
1951	281,571	175,490	20,734	60,511	13,404	378,481	930,290
1952	295,801	182,125	17,903	48,817	13,008	401,336	959,590
1953	312,810	180,188	14,720	56,219	1,930	403,113	968,980
1954	270,159	132,980	10,284	52,662	1,233	394,120	870,438
1955	378,215	138,597	23,702	80,209	3,004	404,829	1,029,546

[1] For total production of secondary zinc see chapter on Secondary Metals—Nonferrous.

TABLE 9.—Primary slab zinc produced in the United States, by States where smelted, 1946–50 (average) and 1951–55, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Texas and West Virginia [1]	Total	
								Short tons	Value
1946–50 (average)	17,854	42,894	101,109	204,903	134,627	172,614	121,353	795,354	$190,705,590
1951	21,770	54,468	108,544	208,482	161,247	189,177	137,939	881,633	321,619,718
1952	21,644	54,340	116,331	214,980	161,242	193,811	143,131	904,479	300,829,716
1953	20,379	54,037	129,904	222,354	134,918	192,279	162,234	916,105	210,154,487
1954	8,576	47,404	92,262	154,024	153,840	180,706	165,607	802,425	173,805,255
1955	21,481	50,625	102,808	207,360	160,901	218,409	195,794	963,504	236,829,283

[1] Includes Missouri, 1947–53 and 1955.

Pennsylvania led, Montana ranked second, and Oklahoma third among the States in producing primary slab zinc in 1955 as in 1954. All slab zinc produced in Montana and Idaho was electrolytic, that in Illinois and Texas was in part electrolytic and in part distilled, but all of that produced in other States was distilled.

BYPRODUCT SULFURIC ACID

Sulfuric acid was made from sulfur dioxide gases produced in roasting zinc-blende (sphalerite) concentrate at zinc smelters where the demand for sulfuric acid warranted. At several plants, quantities of elemental sulfur were also burned to increase acid-making capacity. The production of sulfuric acid at zinc plants from 1951 through 1955 is shown in table 10.

TABLE 10.—Sulfuric acid (basis, 100 percen plants in the United States, 1946–50

Year	Made from zinc blende [1]		Made from nativ	
	Short tons	Value [2]	Short tons	Va
1946–50 (average)	551,842	$7,685,547	206,885	$2,8
1951	635,948	10,218,400	261,106	4,1
1952	664,714	11,031,494	224,671	3,7
1953	636,864	11,397,458	229,951	4,1
1954	612,250	11,642,763	156,984	2,9
1955	782,938	14,687,012	153,622	2,8

[1] Includes acid from foreign blende.
[2] At average of sales of 60° B. acid.

ZINC DUST

The output of zinc dust increased 13 zinc dust reported here is restricted to co with close specifications as to percentage of grading, and fineness of particles and powder and blue powder. The content ranged from 94.1 percent to 99.8 and a ments of zinc dust were 29,300 tons, of wh shipments, and 400 tons was for for stocks of zinc dust declined from 2,100 year to 1,600 tons at the end of 1955.

The average price of all zinc dust shipp with 13.6 cents in 1954 and 13.3 cents in 1 was from zinc scrap (principally galva recovered from zinc ore and as a bypr secondary raw materials used to manufa in the Secondary Metals—Nonferrous cl

TABLE 11.—Zinc dust [1] produced in the Unit 1951–55

Year	Short tons	Value		
		Total	Average per pound	
1946–50 (average)	28,018	$7,899,173	$0.138	1953
1951	31,695	13,438,680	.212	1954
1952	25,113	9,794,070	.196	1955

[1] All produced by distillation.

ZINC PIGMENTS AN

The principal zinc pigments were zinc principal salts were chloride and sulfate. factured from various zinc-bearing mat scrap, and residues. In 1955, 183,000 t these products. Details of the productio are given in the Lead and Zinc Pigmen this volume.

CONSUMPTION AND USES

According to reports from approximately 830 plants, consumption of slab zinc reached a record high of 1,120,000 tons in 1955 compared with 884,300 tons in 1954 and the previous record of 986,000 tons in 1953. In the last quarter of 1955, consumption exceeded 97,000 tons monthly and totaled 293,000 tons—12 percent more than in the first quarter.

The principal uses of zinc continued to be in galvanizing and for making zinc-base alloys (chiefly die castings), which utilized 40 and 38 percent, respectively. The quantity used for galvanizing increased 12 percent and for zinc-base alloys 48 percent over 1954. The expanded use of zinc-base die castings for functional and decorative trim parts of automobiles (of which a record number were manufactured in 1955) was an important factor in bringing about the record overall consumption of slab zinc during the year. Slab zinc used in making brass increased 35 percent over 1954 but was still 18 percent below the quantity consumed in 1953. In addition to the slab zinc used in brassmaking in 1955, 149,600 tons of secondary zinc in copper-base scrap was consumed in making brass and bronze ingots at secondary smelters.

TABLE 12.—Consumption of slab zinc in the United States, 1946–50 (average) and 1951–55, by industries, in short tons [1]

Industry and product	1946–50 (average)	1951	1952	1953	1954	1955
Galvanizing: [2]						
Sheet and strip	136,931	144,329	145,875	164,601	181,558	200,403
Wire and wire rope	45,969	51,792	48,646	44,100	44,882	48,171
Tubes and pipe	78,206	70,221	82,043	88,428	76,891	98,206
Fittings	12,506	21,186	10,366	10,330	10,513	10,586
Other	95,222	103,751	90,759	99,529	89,619	93,775
Total galvanizing	368,924	400,279	377,688	406,988	403,463	451,141
Brass products:						
Sheet, strip, and plate	56,000	67,815	71,706	94,826	52,284	67,550
Rod and wire	37,436	40,056	49,831	47,312	30,809	46,830
Tube	16,150	15,027	17,057	18,136	12,097	15,363
Castings and billets	3,790	7,098	7,262	8,145	5,490	7,518
Copper-base ingots	4,401	5,743	8,223	7,659	6,504	8,062
Other copper-base products	1,313	653	1,529	2,104	895	920
Total brass products	119,090	143,292	155,608	178,182	108,268	146,243
Zinc-base alloy:						
Die castings	226,426	282,812	225,877	297,280	279,676	417,333
Alloy dies and rod	3,448	11,135	9,235	7,140	8,857	11,764
Slush and sand castings	720	2,487	1,577	3,025	2,313	1,720
Total zinc-base alloy	230,603	296,434	236,689	307,445	290,846	430,807
Rolled zinc	72,679	64,085	51,318	54,649	47,486	51,589
Zinc oxide	16,336	18,223	17,205	20,675	18,701	22,433
Other uses:						
Wet batteries	1,470	1,749	1,396	1,417	1,264	1,420
Desilverizing lead	2,503	2,186	2,370	2,425	2,740	2,676
Light-metal alloys	939	3,132	3,266	5,039	3,520	3,484
Other [3]	4,309	4,591	7,243	8,207	8,005	10,019
Total other uses	9,221	11,658	14,275	17,088	15,536	17,599
Total consumption [4]	816,862	933,971	852,783	985,927	884,209	1,119,812

[1] Excludes some small consumers.
[2] Includes zinc used in electrogalvanizing and electroplating, but excludes sherardizing.
[3] Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.
[4] Includes 4,505 tons of remelt zinc in 1951, 4,144 tons in 1952, 3,710 tons in 1953, 3,589 tons in 1954, and 2,997 tons in 1955.

Slab zinc used in rolled-zinc products r
above the 47,500 tons consumed in 1954
the rolling mills remelt and reroll the r
produced from associated fabricating pr
in 1955 totaled 8,100 tons, 12,300 tons
1953. Purchased zinc scrap, in the form
and engravers' plates, totaling 3,500 ton

Production of rolled zinc from both sla
was 53,100 tons compared with 49,000 t
ventories of rolled zinc at the beginning
and 1,900 tons, respectively. In additi
tons of rolled zinc, the rolling mills pro
zinc in manufacturing 15,500 tons of s
products.

TABLE 13.—Rolled zinc produced and quantity
United States, 1954

	1954	
	Short tons	Va
		Total
Production:		
Sheet zinc not over 0.1 inch thick	12,780	$6,985,291
Boiler plate and sheets over 0.1 inch thick	1,117	477,697
Strip and ribbon zinc [1]	33,492	12,040,429
Foil, rod, and wire	1,640	839,564
Total rolled zinc	49,035	20,342,981
Imports	259	88,010
Exports	2,960	1,443,995
Available for consumption	46,404	
Value of slab zinc (all grades)		
Value added by rolling		

[1] Figures represent net production. In addition 12,280 tons
tons in 1955 were rerolled from scrap originating in fabricatin
rolling mills.

Consumption of six commercial grades o
remelt spelter by the various industries
the 1.1 million tons of slab zinc consum
High Grade; 37 percent, Prime Western
7 percent, Brass Special; 2 percent, In
combined Select and Remelt. Record
together with increased use of zinc die
tributing factors to the new record estab
High Grade. Although all grades of zin
the increasing number of continuous galv
to a gradual change to the higher grade
slab zinc used in brass products, nearly 4
25 percent Special High Grade, and 17 p

TABLE 14.—Consumption of slab zinc in the United States in 1955, by grades and industries, in short tons

Industry	Special High Grade	High Grade	Intermediate	Brass Special	Select	Prime Western	Remelt	Total
Galvanizers	21,036	18,486	9,932	49,856	300	349,900	1,401	451,141
Brass mills [1]	30,553	71,027	1,328	8,154	3,800	21,628	753	146,243
Die casters [2]	423,233	101	33			7,346	91	430,807
Zinc rolling mills	8,356	13,571	13,204	15,090	1,200	102		51,589
Oxide plants	764	1,067		7		20,605		22,433
Other	4,484	1,385	021	474		9,073	662	17,599
Total	494,466	105,040	25,118	73,581	5,300	412,044	2,007	1,119,812

[1] Includes brass mills, brass ingotmakers, and brass foundries.
[2] Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy rods.

Consumption of Slab Zinc for All Uses.—The region comprising Illinois, Indiana, Michigan, Ohio, and Wisconsin led in zinc consumption, with over 50 percent of the total for the United States. The Mountain States group, the region of least consumption, (Arizona, Colorado, Idaho, Montana, and Utah) used less than one-half of one percent. Ohio consumed 204,600 tons in 1955, displacing Illinois as the leading consuming State in 1954. Pennsylvania ranked third in 1955, followed by Michigan and Indiana.

Consumption of Slab Zinc for Galvanizing.—The iron and steel industry continued to be the leading consumer of slab zinc, for manufacturing coat steel sheets, wire, tube, pipe, cable, chain, bolts, railway-signal equipment, building and poleline hardware, and numerous other items. Fabricators of sheet steel and job galvanizers also used quantities of zinc in zinc-coating many products. Zinc consumed in coating sheet and strip increased 10 percent over 1954 to 200,400 tons, surpassing the previous record yearly high of 188,400 tons in 1950. Additional continuous galvanizing lines began production, raising the total number in production in the United States from 22 at the end of 1954 to 26 at the end of 1955. Two more lines were under construction, and 9 were in the planning stage. Shipments of galvanized-steel sheets in 1955 reported by American Iron and Steel Institute totaled 2,864,500 short tons, an alltime high compared with the previous high of 2,362,600 tons established in 1954. The principal iron- and steel-producing States are the chief consumers of zinc for galvanizing. Among the 34 States consuming zinc for galvanizing, Ohio ranked first in 1955, Pennsylvania second, Illinois third, and Indiana fourth. Ohio, Pennsylvania, Illinois, and Indiana used 61 percent of the slab zinc consumed for galvanizing in 1955 and 57 percent in 1954.

Consumption of Slab Zinc for Brass Products.—Slab zinc used in making brass products increased 35 percent over 1954 despite widespread flood damage to brass mills in the Connecticut Valley. Mills in Connecticut took 37 percent of the total zinc used in brassmaking in the United States in 1955 and 36 percent in 1954. For many years Connecticut has ranked first among the States in consumption of zinc for brassmaking; Illinois ranked second in 1955, Michigan third, Ohio fourth, and Pennsylvania fifth.

TABLE 15.—Consumption of slab zinc in the Uni
and 1953–55, by geographic divisio

Geographic division and State	1948–52 (average)		1953	
	Short tons	Rank	Short tons	
I. New England:				
Connecticut	60,608	4	73,197	
Maine	90	34	(3)	
Massachusetts	9,411	15	9,395	
New Hampshire	14	38	(3)	
Rhode Island	305	20	610	
Total	70,578	3	83,476	
II. Middle Atlantic:				
New Jersey	21,550	12	27,505	
New York	50,500	6	67,081	
Pennsylvania	127,752	3	135,860	
Total	199,802	2	230,496	
III. South Atlantic:				
Delaware	122	32	(3)	
District of Columbia	36	37	(3)	
Florida	108	33	(3)	
Georgia	1,955	21	1,556	
Maryland	29,219	9	36,850	
North Carolina	4	40		
South Carolina	41	36	(3)	
Virginia	200	30	702	
West Virginia	25,696	11	21,340	
Total	57,471	4	61,810	
IV. East North Central:				
Illinois	155,616	1	157,765	
Indiana	58,655	5	74,329	
Michigan	48,105	7	73,241	
Ohio	141,998	2	165,062	
Wisconsin	12,180	14	13,850	
Total	416,554	1	484,256	
V. East South Central:				
Alabama	20,844	10	25,420	
Kentucky	9,084	16	8,291	
Mississippi				
Tennessee	1,257	25	1,865	
Total	37,185	5	35,576	
VI. West North Central:				
Iowa	5,160	17	5,452	
Kansas	162	31	(3)	
Minnesota	3,606	18	3,005	
Missouri	16,288	13	14,858	
Nebraska	1,544	23	(3)	
Total	26,760	7	25,363	
VII. West South Central:				
Arkansas	1	41	(3)	
Louisiana	504	28	(3)	
Oklahoma	1,456	24	2,220	
Texas	3,408	19	6,641	
Total	5,429	8	9,936	
VIII. Mountain:				
Arizona	60	35	(3)	
Colorado	2,095	20	2,250	
Idaho	485	28	(3)	
Montana				
Utah	8	39	(3)	
Total	2,048	9	2,844	
IX. Pacific:				
California	34,726	8	45,104	
Oregon	533	27	835	
Washington	1,563	22	2,521	
Total	36,822	6	48,460	
Grand total [1]	853,249		982,217	

[1] Excludes remelt zinc and some small consumers of slab zinc.
[3] Nominal quantity consumed included with subtotal for division,

TABLE 16.—Consumption of slab zinc for galvanizing in the United States, 1948–52 (average) and 1953–55, by States

State	Geographic division	1948–52 (average)		1953		1954		1955	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	26,308	6	24,524	7	29,425	6	30,299	6
California	IX	19,204	8	27,116	6	25,462	7	26,941	7
Colorado	VIII	1,966	19	(2)	20	(2)	17	(2)	17
Connecticut	I	2,955	17	3,001	16	3,169	16	3,464	15
Florida	III	108	30	(2)	27	(2)	27	(2)	25
Georgia	III	1,948	20	(2)	22	(2)	22	(2)	22
Illinois	IV	47,902	3	40,605	3	40,412	3	54,076	3
Indiana	IV	20,876	4	35,196	5	39,265	4	45,634	4
Iowa	VI	148	29	242	30	172	30	242	29
Kentucky	V	8,948	9	7,854	9	11,308	9	(2)	18
Louisiana	VII	563	24	(2)	24	818	24	(2)	24
Maine	I	88	31	(2)	29	(2)	31	(2)	33
Maryland	III	28,779	5	30,261	4	33,694	5	40,722	5
Massachusetts	I	5,233	11	4,703	14	5,035	13	5,250	13
Michigan	IV	4,422	14	6,810	10	(2)	11	6,279	11
Minnesota	VI	3,604	15	2,944	17	(2)	18	(2)	16
Mississippi	V							(2)	32
Missouri	VI	4,472	13	4,234	15	4,108	15	4,287	14
Nebraska	VI	315	26	528	26	566	26	(2)	27
New Jersey	II	5,026	12	6,041	12	4,995	14	5,437	12
New York	II	5,846	10	6,356	11	5,864	10	6,949	10
Ohio	IV	81,406	1	83,772	1	74,283	1	100,580	1
Oklahoma	VII	1,453	21	(2)	19	(2)	20	(2)	21
Oregon	IX	260	27	197	31	246	28	202	28
Pennsylvania	II	71,037	2	67,829	2	67,774	2	74,256	2
Rhode Island	I	388	25	(2)	25	(2)	25	(2)	26
South Carolina	III	40	33	(2)	32	(2)	32		
Tennessee	V	922	23	1,305	23	1,185	23	1,385	23
Texas	VII	3,055	16	5,170	13	5,440	12	7,354	9
Utah	VIII	48	32					(2)	31
Virginia	III	189	28	(2)	28	(2)	29	(2)	30
Washington	IX	1,201	22	1,908	21	1,499	21	(2)	20
West Virginia	III	24,839	7	21,069	8	(2)	8	(2)	8
Wisconsin	IV	2,504	18	2,897	18	(2)	19	2,238	19
Total [1]		386,013		[3] 405,068		[3] 401,583		[3] 449,650	

[1] Excludes remelt zinc. Includes zinc used in electrogalvanizing and electroplating, but excludes sherardizing.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes States not individually shown (footnote reference 2).

Consumption of Slab Zinc for Zinc-Base Alloys.—Slab zinc used in zinc-base alloys established a new record high of 430,700 tons in 1955, a 48-percent increase over 1954 and a 40-percent rise above the former record attained in 1953. Large quantities of zinc were consumed in die castings used by automobile manufacturers. A study by the American Die Casting Institute [10] showed that 62 percent (a record number) of the 1955 automobiles used zinc die-cast grilles. The quantity of zinc alloy used per grille ranged from 6 pounds on lighter cars to 25 pounds on heavier models. According to the report, zinc alloy was preferred for automotive grilles, primarily because of its high-quality appearance when chrome-plated and the ease with which plating is accomplished. High impact strenght, low die cost, ability to achieve a high degree of dimensional accuracy without machining, and ability to produce shapes of extreme complexity were among other important factors favoring the use of die-cast zinc. Passenger-car and truck production in 1955 totaled 9.2 million units, compared with 6.6 million units in 1954. Zinc die castings were extensively

[10] American Metal Market, Record use of Zinc Die-cast Grilles in 1955 Model Automobiles: Vol. 62, No. 41, Mar. 1, 1955, p. 1.

TABLE 17.—Consumption of slab zinc for brass
1948–52 (average) and 1953–55,

State	Geographic division	1948–52 (average)		1953	
		Short tons	Rank	Short tons	R
Alabama	V	404	12	(2)	
California	IX	1,622	11	3,067	
Colorado	VIII	95	16	(2)	
Connecticut	I	51,577	1	63,127	
Delaware	III	122	14	(2)	
District of Columbia	III	36	19	(2)	
Georgia	III	7	27	(2)	
Illinois	IV	15,427	2	23,944	
Indiana	IV	3,817	9	13,347	
Iowa	VI	1	31		
Kansas	VI	28	20	(2)	
Kentucky	V	72	18	(2)	
Maine	I	2	29	(2)	
Maryland	III	432	13	(2)	
Massachusetts	I	2,863	10	3,504	
Michigan	IV	13,295	3	19,259	
Minnesota	VI	2	30	(2)	
Missouri	VI	76	17	(2)	
Nebraska	VI	1	32	(2)	
New Hampshire	I	14	22	(2)	
New Jersey	II	5,118	8	6,652	
New York	II	8,952	5	12,655	
North Carolina	III				
Ohio	IV	8,991	4	13,013	
Oregon	IX	12	23	(2)	
Pennsylvania	II	6,307	7	(2)	
Rhode Island	I	7	28	(2)	
Tennessee	V	8	26	(2)	
Texas	VII	28	21	(2)	
Utah	VIII	1	33	(2)	
Virginia	III	12	24	(2)	
Washington	IX	12	25	(2)	
West Virginia	III	101	15	(2)	
Wisconsin	IV	6,429	6	7,305	
Total [1]		125,961		[3] 177,308	

[1] Excludes remelt zinc.
[2] Figure withheld to avoid disclosing individual company confiden
[3] Includes States not individually shown (footnote reference 2).

used in manufacturing home appliances, o
hardware, scientific communications, and
Six States, manufacturing large quantities
home appliances—Illinois, Ohio, Michigan,
and Indiana—consumed 83 percent of the sl
alloys.

Consumption of Slab Zinc for Rolled Zinc
sumed 51,600 tons of slab zinc in making sh
foil, rod, and wire in 1955, a 9-percent increas
zinc had many uses, such as in producing dry-c
stripping, roof valleys, and flashing in build
engraving plates; and heavy plates installed
ship hulls to protect them from corrosion.
in the same geographic areas each year from
the quantity rolled ranged from a low of 47,5
of 98,000 tons in 1945; the average for the
53,800 tons. Illinois led in 1955, with 22,40
by Pennsylvania, Indiana, and New York.

TABLE 18.—Consumption of slab zinc for zinc-base alloys in the United States, 1948–52 (average) and 1953–55, by States [1]

State	Geographic division	1948–52 (average)		1953		1954		1955	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	11	18						
California	IX	13,499	6	14,399	7	12,683	8	23,941	7
Colorado	VIII	34	16						
Connecticut	I	4,748	10	5,737	10	3,549	10	3,707	11
Delaware	III			[2]	15	[2]	13	[2]	13
Illinois	IV	60,160	1	60,613	2	58,953	1	70,979	3
Indiana	IV	13,059	7	15,476	6	16,686	6	24,248	6
Iowa	VI			[2]	17				
Kansas	VI	123	14	[2]	14	[2]	15	[2]	16
Kentucky	V	64	15	[2]	16	[2]	16		
Massachusetts	I	9	19	[2]	19				
Michigan	IV	30,164	3	46,977	3	52,109	3	82,352	2
Missouri	VI	11,340	8	9,499	9	9,106	9	13,683	9
New Jersey	II	9,071	9	13,531	8	13,882	7	20,809	8
New York	II	30,141	4	41,620	4	38,548	4	51,663	4
North Carolina	III	4	20					[2]	15
Ohio	IV	51,276	2	67,094	1	57,844	2	92,306	1
Oregon	IX	259	13	[3]	13	[1]	14	[3]	14
Pennsylvania	II	23,448	5	25,615	5	19,542	5	27,701	5
Rhode Island	I							[3]	18
Tennessee	V					[3]	17	[3]	17
Texas	VII	310	12	[3]	12	2,291	12	[3]	12
Virginia	III	16	17	[3]	18				
Wisconsin	IV	3,245	11	[3]	11	[3]	11	4,618	10
Total [4]		251,571		[3] 307,203		[3] 290,680		[3] 430,716	

[1] Excludes remelt zinc.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes States not individually shown (footnote reference 2).

TABLE 19.—Consumption of slab zinc for rolled zinc in the United States, 1948–52 (average) and 1953–55, by States

State	Geographic division	1948–52 (average)		1953		1954		1955	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Connecticut	I	1,127	7	[1]	7	[1]	7	[1]	7
Illinois	IV	30,892	1	23,066	1	19,310	1	22,371	1
Indiana	IV	11,306	2	[1]	2	[1]	3	[1]	3
Iowa	VI	4,853	5	[1]	5	[1]	5	[1]	5
Massachusetts	I	1,277	6	[1]	6	[1]	6	[1]	6
New York	II	4,057	4	[1]	4	[1]	4	[1]	4
Pennsylvania	II	8,019	3	[1]	3	[1]	2	[1]	2
West Virginia	III	713	8	[1]	8				
Total		63,144		54,049		47,486		51,589	

[1] Figure withheld to avoid disclosing individual company confidential data.

Consumption of Slab Zinc for Other Uses.—Table 20 shows the distribution, by States, of the quantity of slab zinc consumed in slush castings, wet batteries, desilverizing lead, light-metal alloys, zinc dust, chemicals, bronze powders, and zinc oxide and part of the zinc used for cathodic protection. The increase in yearly totals beginning with 1952 is in large measure due to the inclusion of slab zinc consumed for zinc oxide.

TABLE 20.—Consumption of slab zinc for other u
(average) and 1953–55,

State	Geographic division	1948–52 (average)		1953
		Short tons	Rank	Short tons
Alabama	V	30	18	[2]
Arizona	VIII	60	16	[2]
Arkansas	VII	1	27	[2]
California	IX	401	7	522
Colorado	VIII			[2]
Connecticut	I	262	12	[2]
Idaho	VIII	485	6	[2]
Illinois	IV	652	4	3,537
Indiana	IV	154	15	[2]
Iowa	VI	158	14	[2]
Kansas	VI	10	22	[2]
Kentucky	V			
Louisiana	VII	1	28	[2]
Maryland	III	7	23	[2]
Massachusetts	I	28	19	[2]
Michigan	IV	234	13	[2]
Minnesota	VI	1	29	[2]
Missouri	VI	401	8	[2]
Montana	VIII			
Nebraska	VI	1,228	3	[2]
New Jersey	II	1,736	2	1,341
New York	II	605	5	[2]
Ohio	IV	325	10	1,183
Oklahoma	VII	3	25	[2]
Oregon	IX	2	26	[2]
Pennsylvania	II	3,169	1	24,863
Tennessee	V	327	9	[2]
Texas	VII	15	21	[2]
Utah	VIII	7	24	[2]
Virginia	III	26	20	[2]
Washington	IX	290	11	[2]
West Virginia	III	43	17	
Wisconsin	IV	1	30	[2]
Total [1]		10,662		[4] 37,989

[1] Excludes remelt zinc.
[2] Includes slab zinc used for zinc oxide.
[3] Figure withheld to avoid disclosing individual company conf
[4] Includes States not individually shown (footnote reference 3).

STOCKS

National Strategic Stockpile.—The Gene
purchased zinc each month, in accordanc
from the Office of Defense Mobilization
stockpile report,[11] the minimum objectiv
completed for the 6 months ended De
mined domestic lead and zinc continued t
the long-term stockpile to support the do
ponent of the mobilization base.

Producers' Stocks.—Slab-zinc stocks a
end of 1955 totaled 39,000 tons, compare
end of 1954 and 177,000 tons at the end o
inventories for the period 1940–52 were
from a high of 256,000 tons in 1945 to
1950. Continued monthly Government
National Stockpile were an important fac

[11] Stockpile Report to the Congress, July–December 1955, Ex
Defense Mobilization, p. 2.

smelter stocks, as the total supply of slab zinc (domestic smelter production of primary and secondary slab zinc plus imports of metal minus exports) exceeded consumption by almost 90,000 tons.

TABLE 21.—Stocks of zinc at zinc-reduction plants in the United States at end of year, 1951–55, in short tons

	1951	1952	1953	1954	1955
At primary reduction plants	21,343	81,344	176,725	[1] 121,847	37,322
At secondary distilling plants	637	3,677	3,268	1,549	1,938
Total	21,980	85,021	179,993	[1] 123,396	39,260

[1] Revised figure.

Consumers' Stocks.—Slab-zinc stocks held by consumers on December 31, 1955, totaled 123,500 tons, a 19-percent increase over the 103,700 tons held at the beginning of the year. At the average consumption rate of 93,318 tons a month in 1955, stocks on hand at the end of the year plus 16,300 tons of metal in transit to consumers' plants represented a 7-week supply.

TABLE 22.—Consumers' stocks of slab zinc at plants at the beginning and end of 1955, by industries, in short tons

Date	Galvanizers	Brass mills [1]	Die casters [2]	Zinc rolling mills	Oxide plants	Others	Total
Dec. 31, 1954 [3]	56,393	16,188	24,711	4,816	235	1,363	[4] 103,706
Dec. 31, 1955	65,886	16,012	33,731	5,765	301	1,783	[4] 123,478

[1] Includes brass mills, brass ingotmakers, and brass foundries.
[2] Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy rods.
[3] Revised figures.
[4] Stocks on Dec. 31, 1954 and 1955, exclude 476 tons (revised figure) and 595 tons, respectively, of remelt spelter.

PRICES

All the industry-wide changes in zinc-metal prices in 1955 were upward. The quoted price of Prime Western slab zinc, East St. Louis, was 11.50 cents a pound at the beginning of the year and rose to 12.00 cents on April 6, to 12.50 cents on June 16, and to 13.00 cents on September 6. On October 17 several companies raised their selling price to 13.50 cents a pound but canceled the ½-cent increase 2 days later. The price remained at 13.00 cents through December but rose to 13.50 cents on January 6, 1956. The average of the quoted price for the year was 12.30 cents compared with 10.69 cents in 1954. The average weighted yearly price of all grades sold was 12.3 cents a pound in 1955 and 10.8 cents in 1954.

On the London Metal Exchange the monthly mean of the buyers' and sellers' quotations at the close of the morning sessions in 1955 ranged from £85 16s. 9d. per long ton in January to £98 8s. 9d. in December and averaged £90 13s. 9d. for the year as compared with £82 0s. 5d. in 1954. The equivalent of the yearly average in United States money was 11.30 cents per pound (computed at an exchange rate of $2.7913 to the pound sterling).

TABLE 23.—Price of zinc concen

Joplin 60-percent zinc concentrate: [1]	
Price per short ton	dolla
Average price common zinc at—	
St. Louis (spot) [1]	cents per poun
New York [1]	do.
London [2]	do.
Price indexes [3] (1947–49 average=100):	
Zinc (New York)	
Lead (New York)	
Copper (New York)	
Straits tin (New York)	
Nonferrous metals	
All commodities	

[1] Metal Statistics, 1956.
[2] E&MJ Metal and Mineral Markets English quotations
average rates of exchange recorded by Federal Reserve Boar
[3] Based upon price indexes of U. S. Department of Labor.

TABLE 24.—Average monthly quoted prices
Joplin, and of common zinc (prompt deliv
1954–55 [1]

Month	1954		
	60-percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (per pound	
		St. Louis	Lon
January	54.61	9.75	
February	51.33	9.37	
March	52.52	9.66	
April	57.85	10.25	
May	58.23	10.29	
June	62.54	10.96	
July	64.00	11.00	
August	64.00	11.00	
September	67.69	11.44	
October	68.00	11.50	
November	68.00	11.50	
December	68.00	11.50	
Average for year	65.72	10.69	

[1] Joplin: Metal Statistics, 1956, p. 585. St. Louis: Metal St
and Mineral Markets.
[2] Conversion of English quotations into American money ba
Federal Reserve Board.
[3] Average of daily mean of bid and asked quotations at morn

TABLE 25.—Average price received by produc
cents per poun

Grade	1951
Grade A:	
Special High Grade	18.7
High Grade	18.4
Grade B: Intermediate	18.5
Grades C and D:	
Brass Special	18.2
Select	18.0
Grade E: Prime Western	17.9
All grades	18.2
Prime Western; spot quotation at St. Louis [1]	17.9

[1] Metal Statistics, 1956, p. 582.

FOREIGN TRADE [12]

Imports.—Imports (general imports) of zinc in ores and concentrates and as refined metal totaled 674,000 tons in 1955, or 10 percent more than in 1954. Of the 478,000 tons imported in ores and concentrates in 1955, Mexico supplied 39 percent; Canada, 36 percent; and Peru, 18 percent. The remaining 7 percent came mostly from Guatemala, Australia, Union of South Africa (South-West Africa), and Chile.

Of the imports of slab zinc (196,000 tons), Canada supplied 58 percent; Belgian Congo, 8 percent; Mexico, 10 percent; Belgium-Luxembourg, 9 percent; and Peru, 5 percent. The remaining 10 percent came largely from Germany, Italy, Australia (Oceania), French Morocco, and the Netherlands.

TABLE 26.—Zinc imported into the United States, in ores, blocks, pigs, or slabs, by countries, 1946–50 (average) and 1951–55, in short tons [1]

[U. S. Department of Commerce]

Country	1946–50 (average)	1951	1952	1953	1954	1955
Ores (zinc content):						
North America:						
Canada-Newfoundland-Labrador	62,608	98,470	149,130	165,910	[r] 150,830	173,157
Guatemala		6,539	9,744	6,477	3,755	8,353
Honduras	70	154	316	637	792	1,433
Mexico	144,871	143,769	200,647	169,124	[r] 176,092	186,461
Other North America	11	62	171	[3]	[4]	3,704
Total	207,560	246,994	360,008	342,148	[r] 337,069	373,108
South America:						
Argentina	1,676	5,646	603			
Bolivia	11,494	7,849	14,603	22,528	11,440	1,833
Chile	8	1,088	33	3,247	1,797	4,858
Peru	30,021	29,130	44,337	84,305	93,210	83,915
Other South America	126	380	320	380	31	142
Total	43,925	43,999	59,896	110,529	106,484	90,748
Europe:						
Belgium-Luxembourg						1,646
Italy	4,580			8,738		
Netherlands				3,009		
Spain	7,008	4,302	16,647	8,017		
United Kingdom						1,497
Yugoslavia		1,766	2,512	10,820	4,871	
Other Europe	[3]			1	15	
Total	11,588	6,148	19,159	31,185	4,886	3,043
Asia:						
Japan	1,004		1,389			
Philippines	8	80	1,604	2,104	444	465
Other Asia	477	70	7	778		
Total	1,480	156	3,060	2,882	444	465
Africa:						
Algeria				2,804		
Union of South Africa	2,480	2,655	4,917	13,356	4,183	5,050
Other Africa	[4]	[4]	198			
Total	2,480	2,655	5,115	16,160	4,183	5,050
Oceania:						
Australia	2,493	2,825	2,398	10,820	2,361	5,630
Total	2,493	2,825	2,398	10,820	2,361	5,630
Grand total: Ores	269,536	302,777	449,636	513,724	[r] 455,427	478,044

See footnotes at end of table.

[1] Figures on imports and exports compiled by Mac B. Price and Elsie D. Page, Division of Foreign Activities, Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 26.—Zinc imported into the United States, in by countries, 1946–50 (average) and 1951–55, in

Country	1946–50 (average)	1951	19
Blocks, pigs, or slabs:			
North America:			
Canada	87,301	85,066	6
Mexico	12,466	760	1
Total	99,767	85,826	8
South America: Peru	241	20	
Europe:			
Belgium-Luxembourg	1,330	612	
Germany	327		[4]
Italy	852		
Netherlands	401	264	
Norway	2,228	882	
United Kingdom	111		
Yugoslavia	97		
Other Europe	266	3	
Total	5,611	1,751	2
Asia:			
Japan	4,323		
Other Asia	25		
Total	4,348		
Africa:			
Belgian Congo			
Federation of Rhodesia and Nyasaland			
French Morocco		440	
Mozambique			
Total		440	
Oceania: Australia	680		
Grand total: Blocks, pigs, or slabs	110,647	88,043	11

[1] Data include zinc imported for immediate consumption plus mat
[r] Revised figure.
[3] Less than 1 ton.
[4] West Germany.
[5] Northern Rhodesia.

Exports.—Exports of zinc in zinc ore, con zinc, sheet, scrap, and dust totaled 43,600 t compared with 46,200 tons valued at $9,751,0 to the export items listed in tables 28 and 2 exported (as in other years) in brass, pigm alloy and as zinc coatings on steel products pigments and chemicals are given in the Lead Zinc Salts chapter of this volume.

Of the 18,000 tons of exported slab zinc, ceived 42 percent, Argentina, 34 percent; B percent; Mexico, 4 percent; and other cou 3,700 tons of sheets, plates, strips, or other fo fied were shipped to Canada, Mexico, Cub countries as listed in table 28.

Tariff.—The duty on slab zinc (gross weigh pound and that on ores and concentrates (zi pound throughout 1955. The rates of duty under the Tariff Act of 1930, in specific yea the 1953 Minerals Yearbook, Zinc, chapter (

TABLE 27.—Zinc imported for consumption in the United States, 1946–50 (average) and 1951–55, by classes [1]

[U. S. Department of Commerce]

Year	Ore (zinc content)		Blocks, pigs, slabs		Sheets		Old, dross, and skimmings [2]		Zinc dust		Total value [3]
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1946–50 (average)	168,524	$13,617,416	109,904	$24,863,164	73	$26,869	9,157	$1,018,345	121	$19,055	$39,544,849
1951	197,995	27,043,611	88,043	31,109,279	149	84,044	6,603	284,030	154	74,362	58,595,326
1952	542,314	105,428,691	113,053	36,219,619	47	23,557	3,489	535,426	133	38,932	142,246,225
1953	449,732	47,918,150	227,654	50,281,745	106	78,507	5,915	556,592	1,045	161,612	98,994,606
1954	[4] 480,918	[4] [5] 52,481,723	160,138	[4] [5] 33,714,309	259	88,010	1,087	103,486			[4] [5] 86,387,528
1955	334,648	36,810,856	195,059	46,452,269	431	[5] 148,389	284	31,529	72	[5] 17,994	[5] 83,461,037

[1] Excludes imports for manufacture in bond and export, which are classified as "imports for consumption" by U. S. Department of Commerce.

[2] Includes dross and skimmings as follows: 1946–50 (average)—3,945 tons ($386,093); 1951—6,457 tons ($242,998); 1952—3,019 tons ($389,361); 1953—2,925 tons ($250,544); 1954—316 tons ($33,181); 1955—108 tons ($3,060).

[3] In addition, manufactures of zinc were imported as follows: 1946–50 (average)—$33,473; 1951—$51,700; 1952—$11,719; 1953—$5,855; 1954 [5]—$41,454; 1955 [5]—$190,076.

[4] Revised figure.

[5] Owing to changes in tabulating procedures by U. S. Department of Commerce, data known to be not comparable with earlier years.

TABLE 28.—Slab and sheet zinc exported from the
1952–55, in short ton

[U. S. Department of Comme

Destination	Slabs, pigs, and blocks			
	1952	1953	1954	1
North America:				
Canada	171	7	9	
Cuba	33	12		
Mexico	351	457	517	
Other North America	3	5		
Total	558	481	526	
South America:				
Argentina	601		2,205	0
Brazil	4,089	1,687	2,900	
Chile	365	141	230	
Colombia	1	23		
Other South America	73	32	14	
Total	5,189	1,883	5,349	6
Europe:				
Austria	980			
Belgium-Luxembourg		840	3,136	3
Denmark				
France	6,680	60	50	
Germany, West	607		2,777	
Italy			224	
Switzerland	498		1,064	
United Kingdom	40,423	13,859	10,052	7
Other Europe	67	34	673	
Total	49,270	14,789	17,982	10
Asia:				
India	2,036		112	
Israel and Palestine	60	34		
Japan			28	
Korea, Republic of	90	771	948	
Pakistan	111			
Philippines	3		16	
Other Asia	9	10	33	
Total	2,309	815	1,137	
Africa:				
Egypt	385			
Union of South Africa				
Other Africa	3	[1]		
Total	388	[1]		
Oceania				
Grand total	57,714	17,969	24,994	17,

[1] Less than 1 ton. [2] Israel.

TECHNOLOGY

Technical progress was made in producing
valuable technologic information was pu
staffs of companies, trade journals, Federal
various research units.

The Federal Bureau of Mines [13] [14] and th
published reports on several investigations

[13] Bishop, O. M., and Mentch, R. L., Zinc: chap. in Mineral Fact
556, 1955, 27 pp.

[14] Hamilton, W. H., and McLellan, R. R., Investigations of Ko
Colo.: Bureau of Mines Rept. of Investigation 5138, 1955, 28 pp.

[15] Albritton, C. C., Jr., Richards, Arthur, Brokaw, A. L., and R
Lead and Zinc Deposits in Goodsprings (Yellow Pine) District, Ne

[16] Bodenlos, A. J., and Ericksen, G. E., Lead-Zinc Deposits of Cor
Huayhuash, Peru: Geol. Survey Bull. 1017, 1955, 166 pp.

[17] Flint, A. E., and Brown, C. E., Exploratory Drilling for Evid
County, Iowa: Geol. Survey Bull. 1027-K, 1956, pp. 471–499.

TABLE 29.—Zinc ore and manufactures of zinc exported from the United States, 1946–50 (average) and 1951–55

[U. S. Department of Commerce]

Year	Zinc ore, concentrates and dross (zinc content)		Slabs, pigs, or blocks		Sheets, plates, strips, or other forms, n. e. s.		Zinc scrap (zinc content)		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1946–50 (average)	[1] 1,821	[1] $279,100	58,211	$13,911,883	8,871	$3,502,273	(2)	(2)	820	$257,076
1951	[1] 3,090	[1] 792,800	36,510	15,592,994	6,579	4,360,689	4,613	$871,302	723	400,656
1952 [3]	[1] 3,370	[1] 899,162	57,714	24,508,568	4,231	2,960,769	972	282,816	(4)	(4)
1953 [3]	[1] 2,953	[1] 768,600	17,969	4,620,452	4,628	2,637,240	1,000	169,517	502	181,055
1954 [3]			24,994	5,393,938	4,045	2,183,170	16,089	2,023,493	509	150,756
1955 [3]			17,904	4,127,420	3,057	2,192,882	21,612	2,249,583	445	161,956

[1] Effective Jan. 1, 1949 "dross" included with "scrap."
[2] Classification established Jan. 1, 1949. Not included in 1946–50 averages, 1949—1,570 tons ($224,291) and 1950—6,212 tons ($674,235).
[3] Effective Jan. 1, 1952 zinc and zinc alloy semifabricated forms, n. e. c., were exported as follows: 1952—$191,746 (quantity not available); 1953—286 tons, $151,496; 1954—543 tons, $257,316; 1955—651 tons, $295,685.
[4] "Dust" included with "scrap."

Geologic studies by the Federal and State Governments have been carried on since 1942 in the Wisconsin–Illinois–Iowa zinc-lead district, according to a paper published in 1955.[18] The detailed stratigraphic studies made it possible to map the stratigraphic structural features that controlled the deposition of the zinc-lead ore. Prospecting on the basis of this mapping led to discovery of significant ore bodies.

Improvements in prospecting and drilling equipment and in adapting the equipment to specific jobs helped to reduce prospecting and mining costs in the Tri-State zinc-lead district (Kansas, Southwestern Missouri, Oklahoma).[19]

A dual-motor-design control system for mine hoists, using two AC motors geared to a common main-drive shaft, was operated successfully for several years at the Austinville, Va., zinc-lead mine of New Jersey Zinc Co., and similar-type controls have been installed at three other company mines.[20]

The use of the fluidization technique in roasting zinc concentrate has expanded. More than 80,000 tons of zinc metal per year was being produced from concentrate roasted by Fluo-Solids reactor systems for further treatment, either by pyrometallurgical or electrowinning methods.[21]

Research connected with the electrolytic production of zinc done by one company achieved significant results, which were described as follows: [22]

In the electrolytic production of "Special High-Grade" zinc, the restriction of lead content to 2 or 3 parts per 100,000 is essential, but most difficult to achieve owing to the need for employing lead anodes in the electrolysis. The Research Department discovered and patented a process of effecting this lead control very simply and cheaply by the addition of small amounts of strontium salts to the

[18] Agnew, A. F., Application of Geology to the Discovery of Zinc-Lead Ore in the Wisconsin-Illinois-Iowa District: Min. Eng., vol. 7, No. 8, August 1955, pp. 781–795 (A. I. M. E. Trans., vol. 202).
[19] Clarke, S. S., and Brockie, Douglas C., Jackleg Drilling in the Tri-State District; Longhole Prospecting and Production: Min. Eng., vol. 8, No. 1, January 1956, pp. 27–30.
[20] Newland, W. Trent, and Myles, A. H., Mine Hoists With Dual AC Motors Operated Successfully: Min. Cong. Jour., vol. 41, No. 9, September 1955, pp. 42–45.
[21] Counselman, Theodore B., How Fluidization Can Serve the Mineral Industries: Eng. Min. Jour., vol. 156, No. 3a, Mid-March 1955, pp. 70–75, 98.
[22] Asarco Products and Processes, brochure accompanying 57th Annual Report to Stockholders of the American Smelting & Refining Co. for the year ended Dec. 31, 1955.

electrolyte. This discovery has lead to increased
Christi refinery and, at the same time, yields a
mercial grade. The process has now been licen
zinc producers both in the United States and ab

A zinc coating that is either sprayed or
effect providing a "cold-galvanized"
reported to offer excellent corrosion resist
and refinery installations.[23] The inorganic
ground zinc in a water-soluble silicate
additive to effect chemical curing), app
salt-water atmospheres. At several G
material outperformed galvanized coating

According to a published paper,[24] form
zinc-base alloy last 3 to 4 times as long as
zinc alloys. The greater life results from
particles in the die matrix to increase we
2,720,459) (SG–j, Zn).

Conversion coatings for cadmium and
reaction between the metal surface an
economical and versatile finishes for cadm
and zinc-base die castings. With minor mo
conditions, a wide range of surface finish
using expensive equipment.[25]

The results of a study of metallic ma
zinc were published.[26] Refractory boron
resist corrosion by molten zinc. Coatings o
boron were applied to steel by several me
of the diffusion coatings was partly elim
were applied to type-416 chromium steels
Welded coatings made with a tungsten ar
made of other welding methods. Sintered c
and chromium borides resisted corrosion
oxidation at higher temperatures.

A new type of silver-zinc storage batterie
the United States Navy was described.
as large and one-sixth as heavy, this type
as powerful as conventional lead-acid stora
were employed to power a wide range of el
certain classes of missiles.[27]

WORLD REVIEW

World mine production of zinc in 1955 w
more than in 1946. Annual increases ove
made in all years since 1946 except 1954. T
to be the leading producer, followed in ord
Mexico, Australia, and Peru. Together,

[23] Stormont, D. H., This Zinc Coating Can Be Applied in Field
5, 1955, pp. 114–115.
[24] Holzwarth, J. C., and Boegehold, A. L., "Gmoodle"—A Lo
vol. 60, No. 5, May 19, 1956, pp. 49–53.
[25] Foley, Edward F., Jr., Conversion Coatings for Cadmium a
February 1956, pp. 86–90.
[26] Hodge, Webster, Evans, R. M., and Haskins, A. F., Metal
Jour. Metals, vol. 7, No. 7, July 1955, pp. 824–832.
[27] American Metal Market, Yardney Electric Books Navy Ba
1955, p. 7.

64 percent of the world output as listed in table 30. A major factor in the increased world mine production was the cooperation of the United States industry and Government in supplying capital, technical personnel, and equipment for many of the zinc and lead-mining enterprises abroad.

TABLE 30.—World mine production of zinc (content of ore),[1] by countries,[2] 1946–50 (average) and 1951–55, in short tons[3]

[Compiled by Augusta W. Jann

Country[3]	1946–50 (average)	1951	1952	1953	1954	1955
North America:						
Canada	284,161	341,112	371,802	401,762	376,491	428,474
Guatemala	[4] 370	7,100	9,000	6,700	4,400	10,400
Honduras[5]	[6] 117	154	316	636	701	1,433
Mexico	202,012	198,486	250,638	240,715	246,441	296,961
United States[7]	611,799	681,189	660,001	547,430	473,471	514,671
Total	1,098,459	1,228,041	1,297,757	1,206,243	1,101,504	1,251,939
South America:						
Argentina	14,719	17,058	16,971	17,735	[8] 22,000	23,260
Bolivia (exports)	20,318	33,059	39,263	26,427	22,403	23,509
Chile	[4] 70	675	3,650	3,500	[8] 1,650	3,200
Peru	72,909	111,644	140,925	153,334	174,784	183,074
Total	108,106	163,036	200,809	200,996	[8] 220,840	233,043
Europe:						
Austria	2,476	3,698	5,400	4,826	5,140	5,787
Finland[5]	2,470	3,300	7,700	3,500	6,000	23,300
France	8,631	13,881	10,100	13,200	11,000	11,400
Germany, West	47,188	83,486	88,956	100,506	103,867	101,558
Greece	2,380	6,900	8,000	8,300	7,900	13,500
Ireland	[4] 450	1,387	1,892	1,819	1,680	[8] 1,050
Italy	70,961	111,039	124,466	111,929	112,792	131,501
Norway	6,300	6,029	6,160	5,661	5,917	7,193
Poland[9]	[8] 85,000	110,000	110,000	130,000	120,000	139,000
Spain	53,000	82,000	95,000	92,000	97,000	102,000
Sweden	40,016	42,238	51,987	49,700	64,407	64,816
U. S. S. R.[10]	126,000	182,000	226,000	279,000	303,000	330,000
United Kingdom	8	214	1,707	3,187	3,905	3,167
Yugoslavia	38,507	43,453	52,678	66,106	63,052	65,800
Total[11]	496,000	707,000	820,000	900,000	962,000	1,044,000
Asia:						
Burma			2,400	4,300	6,400	9,100
India	[4] [6] 70	1,300	2,500	2,000	2,600	2,000
Iran[12]		13,200	5,500	6,200	5,800	[8] 5,500
Japan	39,261	71,011	96,418	106,507	120,504	119,486
Korea, Republic of	74	(13)	550	22		
Philippines		170	1,770	830		
Thailand (Siam)	[4] 127	570	550	2,000	3,000	3,200
Turkey[5]	740	440	990	4,400	6,100	580
Total[11]	40,500	91,100	118,400	138,700	159,800	159,000
Africa:						
Algeria	6,817	10,886	12,337	21,120	29,700	34,200
Angola		300	50	110		
Belgian Congo	50,032	97,780	109,071	138,661	94,015	74,700
Egypt	[13] 216	1,579	977	282	260	757
French Equatorial Africa	147	571	416			
French Morocco	4,200	21,445	31,263	58,805	37,908	48,083
Nigeria	[6] 121		57	71		
Rhodesia and Nyasaland, Federation of: Northern Rhodesia	[8] 23,759	40,616	41,140	43,353	38,672	38,070
South-West Africa	8,815	16,300	[7] 17,200	[7] 17,400	[7] 22,000	10,500
Tunisia	2,846	3,011	3,000	4,020	5,810	5,990
Total	103,043	193,478	216,401	263,912	228,365	221,300

See footnotes at end of table.

TABLE 30.—World mine production of zinc (co
50 (average) and 1951–55, in sh

Country[3]	1946–50 (average)	1951
Oceania: Australia	206,517	213,700
World total (estimate)[3]	2,050,000	2,600,000

[1] Data derived in part from the Yearbook of the American
Statistical Yearbook, and the Statistical Summary of the M
London).
[2] In addition to countries listed, Bulgaria, Czechoslovakia,
Korea also produce zinc, but production data are not ava
included in total.
[3] This table incorporates a number of revisions of data p
not add to totals shown owing to rounding where estimated
[4] Average for one year only, as 1950 was first year of comm
[5] United States imports. [6] Average for 1948–50.
[8] Smelter production. [10] Year ended March 21 of ye
[11] Data not available; estimate by senior author of chapter

World smelter production of zinc in
consecutive year and established an all
tons compared with 2.7 million tons in
were the only countries that did not ex
put.

Tables 30 and 31 show the quantity
throughout the world by individual co
which consumed about 35 percent, of th
in 1955, mined about 16 percent, and sm
cent of the total.

NORTH AMER

Canada.—Mine production of recov
from 376,500 tons in 1954 to 428,500 s
high. Smelter production of slab zinc
ores was about 257,000 tons, or 43,200 t
zinc was produced by Consolidated Mini
Ltd., at Trail, British Columbia, and Hu
Co., Ltd., at Flin Flon, Manitoba.

The zinc industry of Canada [28] in 195
of zinc in concentrate, of which 168,1
United States; and the remainder to the
France, and Norway. Exports of refine
States and the United Kingdom, tota
consumption of zinc was 58,500 tons. I
percent of Canada's mine output of zinc
Saskatchewan, 12 percent; Newfoundla
percent; and Yukon, Nova Scotia, and

The principal zinc-producing mine, th
solidated Mining & Smelting Co. of C
British Columbia, produced 2,836,600 t
ore, which was treated in its 11,000-ton
The mill also treated 52,000 tons of cus
mined and milled 685,800 tons of ore fr

[28] Neelands, R. E., Zinc in Canada, 1955 (Preliminary): C
Ottawa, No. 27, 10 pp.
[29] Consolidated Mining & Smelting Co. of Canada, Ltd., An
ending Dec. 31, 1955.

TABLE 31.—World smelter production of zinc by countries, 1946–50 (average) and 1951–55, in short tons [1 2]

[Compiled by Augusta W. Jann]

Country	1946–50 (average)	1951	1952	1953	1954	1955
North America:						
Canada	194,187	218,578	222,200	250,961	213,810	257,006
Mexico	56,006	64,761	[3] 55,542	[3] 58,481	[3] 60,477	[3] 61,878
United States	795,354	881,633	904,479	916,105	802,425	963,504
Total	1,045,547	1,164,972	1,182,221	1,225,547	1,076,712	1,282,388
South America:						
Argentina	3,578	11,716	11,023	12,787	[4] 12,000	14,881
Peru	1,308	959	5,750	9,819	16,935	18,801
Total	4,886	12,675	16,773	22,606	[4] 29,000	33,682
Europe:						
Belgium [5]	158,765	221,439	205,910	213,217	234,481	232,840
Czechoslovakia	[4] 2,480	[4] 2,200	(6)	(6)	(6)	(6)
France	57,319	82,185	88,255	80,219	122,249	123,569
Germany, West	63,193	155,029	162,278	163,430	184,804	197,026
Italy	28,567	52,259	60,463	60,214	74,356	77,761
Netherlands	13,337	24,918	28,555	27,780	28,702	30,865
Norway	42,120	45,002	43,248	42,767	48,767	49,738
Poland [4]	85,000	125,000	132,000	162,000	157,000	172,000
Rumania	[4] 2,870	[4] 3,000	(6)	(6)	(6)	(6)
Spain	21,916	23,529	23,543	25,490	25,053	26,231
U. S. S. R. [4]	120,000	182,000	220,000	279,000	303,000	330,000
United Kingdom	76,200	78,100	76,984	81,433	90,980	91,108
Yugoslavia	8,178	14,576	15,943	16,038	15,040	15,176
Total [4]	686,000	1,010,000	1,071,000	1,165,000	1,293,000	1,355,000
Asia:						
China [4]	220	200	200	400	[4] 13,800	[4] 16,500
Japan	28,329	62,104	77,197	85,001	111,748	124,036
Total [4]	28,550	62,300	77,400	85,400	125,500	140,500
Africa:						
Belgian Congo				8,599	35,274	37,443
Rhodesia and Nyasaland, Federation of: Northern Rhodesia	23,759	25,301	25,636	28,370	29,736	31,248
Total	23,759	25,301	25,636	36,969	65,010	68,691
Australia	87,730	86,251	97,930	100,999	117,066	113,200
World total (estimate)	1,880,000	2,360,000	2,470,000	2,640,000	2,710,000	2,990,000

[1] Data derived in part from the Yearbook of the American Bureau of Metal Statistics, the United Nations Monthly Bulletin and the Statistical Yearbook, and the Statistical Summary of the Mineral Industry Colonial Geological Surveys, London).
[2] This table incorporates a number of revisions of data published in previous zinc chapters. Data do not add to totals shown due to rounding where estimated figures are included in the detail.
[3] In addition other zinc-bearing materials totaling 3,746 tons in 1952; 30,288 in 1953; 18,545 in 1954; and 37,442 in 1955.
[4] Estimate.
[5] Includes production from reclaimed scrap.
[6] Data not available; estimate by senior author of chapter included in total.

near Salmo, Bluebell lead-zinc mine at Riondell, and Tulsequah zinc-lead-copper mines on the northwest coast.

Other British Columbia producers of zinc concentrate were Canadian Exploration, Ltd., near Salmo; Reeves Macdonald Mines, Ltd., near Nelway; Britannia Mining & Smelting Co., Ltd. (producing copper-zinc ore) on Howe Sound; Sheep Creek Gold Mines, Ltd., Lake Windermere district; Sunshine Lardeau Mines, Ltd., near Camborne; Violamac Mines, Ltd., near Sandon; Yale Lead & Zinc Mines, Ltd., Ainsworth; Silver Standard Mines, Ltd., near Hazelton; and Giant Mascot Mines, Ltd., near Spillimacheen.

At Flin Flon, Manitoba, the Hudson B
Ltd., ran its copper-zinc mine, 6,300-ton
refining plant at a high level in 1955. Th
vertical depth of 5,000 feet. Ore reserves
16.5 million tons averaging 3.15 percent
0.068 ounce gold, and 0.143 ounce silver
reserves included some 800,000 tons of zi
26.6 percent zinc. During the year, the
from 2 new properties—the North Star M
Flon; and the Schist Lake Mine, 3 miles n
company produced 67,400 tons of zinc f
milled from its main Flin Flon and other r
erties. In addition, 24,600 tons of direc
tons of zinc-plant residues were treated, a
the Don Jon Mines was milled.

In Ontario, Geco Mines, Ltd., began u
its copper-zinc deposits at Manitouwadg
Basin Mines, Ltd., continued exploration
northwest of Sudbury. Jardun Mines, Lt
lead concentrates from its mine 18 miles nc

The leading Quebec producer of zinc c
Barvue Mines, Ltd., at its open-pit mine a
County. Other Quebec producers of zinc
Sullivan Mines, Ltd., Normetal Mining C
Corp., Ltd., Waite Amulet Mines, Ltd., a
Corp., Ltd. (all treating copper-zinc ore);
Golden Manitou Mines, Ltd. (treating
Anacon Lead Mines, Ltd., New Calumet
donald Mines, Ltd. (zinc-lead and zinc ore

In New Brunswick the Brunswick Mini
exploration, development, and research, i
its lead-zinc properties into production, c
pilot mill began production in February 1
June 1 because of unsatisfactory results; an
was begun with the assistance of Battelle
cedures were being developed, which will
in 1956.[30] Heath Steel Mines, subsidiary
Ltd., explored and developed its lead-zin
Little River, 30 miles from Newcastle, Ne
were sunk, a third deposit was being prepa
was cleared constructing a mill. Prospec
also carried on by the New Larder "U" I
Explorations (Canada), Ltd. (subsidiary o
and Middle River Mining Co., Ltd. (subsi
Co.). Keymet Mines, Ltd., produced z
15 miles north of Bathurst.

Newfoundland zinc output came from
properties at Buchans. Ore mined and tre
tons, yielding about 100,000 tons of lead, zi
Output was reduced by a 5-week strike. T
by rail to Botwood and from there by se
States markets. Ore reserves were esti

[30] St. Joseph Lead Co., Ninety-Second Annual Report to the

In Yukon, United Keno Hill Mines, Ltd., 500-ton concentrator produced lead and zinc concentrates; Mackeno Mines, Ltd., carried out underground development and ran its 220-ton mill intermittently.

At Stirling, Cape Breton Island, Nova Scotia, Mindamar Metals Corp., Ltd., mined and produced zinc and bulk copper-lead concentrate.

Cuba.—Production of zinc concentrate began in Cuba in February 1955 with installation of a 50-ton copper-zinc flotation mill at the San Fernando mine, Las Villas Province, which had been idle many years. About 200 tons monthly of zinc concentrate, averaging 56–58 percent zinc, and a smaller tonnage of 25-percent copper concentrate were produced. The flotation mill at the "Los Cerros" copper mine in Las Villas Province also produced some zinc concentrate in 1955.

Greenland.—Nordic Mining Co., Ltd., worked on developing and equipping the Mestersvig lead-zinc mine in East Greenland. The mill and auxiliary facilities were installed underground in excavations in rock near the ore body. Annual output was expected to be about 11,000 short tons of lead concentrate and 8,800 tons of zinc concentrate when capacity is reached. The company concluded a 7-year contract with the shipping company of J. Lauritzen for transporting lead and zinc concentrates from Mestersvig, estimated at a total of 132,000 short tons, to various destinations in Europe and the United States.[31] Because of ice conditions, ships usually go into Mestersvig only 4 or 5 weeks a year, during the August-September season.

Guatemala.—The zinc- and lead-producing companies in Guatemala were Minerales Nacionales and Compania Minera de Guatemala, S. A. The total output of zinc (content of concentrate), was 10,400 short tons, the largest since 1952. The Compania Minera de Huehuetenango [32] installed a $1 million lead-zinc mill at its mine.

Mexico.—Zinc output from mines in Mexico increased 20 percent over 1954 to a record high of 297,000 short tons in 1955. The increase was attributed to a larger tonnage of ore mined from old lead and zinc properties and a more efficient zinc smelter recovery. Average zinc content of the ore mined also increased in comparison to lead.

A new law entitled, "Law of Taxes and Promotion of Mining," [33] was published in the Diario Oficial on December 31, 1955, and became effective on January 1, 1956. Provisions of this law included reduced production taxes on certain types of metal-mining operations and increased surface taxes on mining claims. Certain stipulations affecting lead and zinc mining are given in the Lead chapter of this volume. The 25-percent export tax ad valorem was not altered.

During the year collective labor contracts of most companies were revised to provide wage increases (estimated at 12 percent), in addition to various fringe benefits. Labor laws and regulations did not permit the mine and smelter companies to accomplish the labor-force reduction during the periods of weak market prices. They therefore hesitated to hire more men during periods of high prices.

American Smelting & Refining Co. properties producing zinc and lead in 1955 included the Charcas unit at Charcas, San Luis Potosi; Neustra Senora at Cosalá, Sinaloa; Parral, Santa Barbara, and Santa Eulalia units, Chihuahua; and Taxco, Guerrero. Mines leased or owned in part under American Smelting management were the Aurora-

[31] Metal Bulletin (London), No. 4078, Mar. 10, 1955, p. 17.
[32] Engineering and Mining Journal, vol. 156, No. 9, September 1955, p. 202.
[33] Bureau of Mines, Mineral Trade Notes: Special Suppl. 48, vol. 42, No. 1, January 1950.

Xichu unit, Guanajuato; Cia. Metalurgi
Montezuma Lead Co. mines at Santa Bar
Pichachoas in Chihuahua. Zinc fume was
slag-fuming plant at the Chihuahua lead s
produced at the Rosita (Coahuila) zinc-retc

Zinc-producing subsidiaries and units of
Ltd., were the Cia. Minera de Penoles, S.
(owned and leased lead-zinc-silver mines);
Jalisco (lead-zinc mines); and Topia unit,
and leased silver-lead-zinc mines). The c
was shipped to the Blackwell smelter in Ok
centrate was smelted in the Cia. Metalur
smelter at Torreon, Coahuila. San Francis
(an American Metal Co. interest) at San
huahua, was also a large producer of zinc a

El Potosi Mining Co. (subsidiary of Hov
of large quantities of lead and zinc concen
its El Potosi mine at Chihuahua and El Ca
in the State of Chihuahua.

Four mines of Fresnillo Co., Inc.,[34] were
mills having a daily capacity of 4,300 short
1955, ore reserves were 3,977,800 tons assa
percent zinc, 0.4 percent copper, 8.0 ounces
gold per ton. The Fresnillo mine delivered
to the mill during the fiscal year ended Ju
at this plant, including that from other near
tons, yielding 50,900 tons of zinc concent
concentrate, 6,800 tons of copper concentrat
gold concentrate.

Minas de Iquala, S. A., subsidiary of Eag
zinc-lead-copper mine at Parral, Chihuahu
geared to a run-of-mine ore output of 28,50

The Zinc Nacional, S. A., Waelz plant at
of-mine zinc carbonate and zinc oxide ores.
shipped to the National Zinc Co. smelter at

SOUTH AMERICA

Argentina.—The Aguilar mine of Compar
(subsidiary of St. Joseph Lead Co.) in the Pr
to be Argentina's only producer of large qu
concentrates. Its output in 1955 [35] of 46,50
centrate and 30,700 tons of lead concentrate
cent, respectively, over 1954, largely becaus
equipment, which began arriving late in 1
trate was shipped to Cia. Metalurgica Au
Rivadavia, southern Argentina, for smeltin
naces. Working conditions and metallurgica
much improved in 1955.

In San Juan Province development of the
silver mining property of National Lead Co
satisfactorily in 1955, according to the comp

[34] Metal Bulletin (London), No. 4046, Nov. 22, 1955, pp. 26–28.
[35] St. Joseph Lead Co. Ninety-Second Annual Report to the Stockh

new mill and other facilities were scheduled to be in use by mid-1956.

Bolivia.—Declining mineral production and inadequate investment and exploration characterized the Bolivian mining industry during 1954 and 1955. Neither the nationalized mines nor the medium and small privately owned mines have had adequate investment in recent years. Labor output has declined. Zinc production in 1955 (23,500 short tons), although 1,100 tons more than in 1954, was 15,800 tons less than in 1952.

In late 1955 a decision was made to invite bids from foreign firms to exploit the lead-zinc deposits at the nationalized Mathilde mine. A study to evaluate all factors and recommend measures to improve production was undertaken by the Ford, Bacon & Davis consulting firm (a United States company) with funds provided by the International Cooperation Administration at the request of the Bolivian Government.

Brazil.—Although no significant production of zinc was reported in Brazil in 1955, interest in the possibility of future large zinc-lead mining operations was aroused by a report of an important lead-zinc (and copper) discovery in western Minas Gerais, Municipality of Vasante (Paracatu).

Chile.—Most zinc concentrate produced in Chile in 1955 came from the mining and milling of Cia. Minera Aysen in the south of Chile. The only other reported zinc producer was Cia. Minera e Industrial "Bellavista", S. A., which produced zinc concentrate for its own use.

Peru.—Mine production of zinc in Peru increased in 1955 for the eighth year in succession; the mine ouptut (183,100 short tons or 5 percent more than in 1954) was more than 3 times that of 1947. Exports of zinc (mostly to the United States) totaled 161,500 short tons, of which 141,000 tons was contained in ore and concentrate and 20,500 tons was refined zinc.

Cerro de Pasco Corp., leading zinc producer in Peru, operated zinc-lead-copper-silver mines at Cerro de Pasco, Morococha, Casapalca, San Cristobal, and Yauricocha, with mills at the first three mines and at Mahr; it also had smelting and refining works at La Oroya. The works at La Oroya include, besides the lead and copper smelters and refiners, an electrolytic zinc plant and a new Sterling-process electrothermic zinc plant. According to the annual report,[36] production of refined zinc was below expectations, due both to a lack of power in December and to a delay in the zinc-development program. Difficulties at the electrothermic zinc plant were expected to be overcome by modifications, which should be completed by the end of 1956. Meanwhile, the capacity of the electrolytic plant was being expanded to 90 short tons per day; construction work on the project was scheduled for completion in mid-1956. The combined plants, which complement each other technologically, were expected to attain full production in 1957 soon after the Paucartambo hydroelectric plant, under construction during the year, is completed. As a result of the increases in the zinc price, a somewhat larger proportion of low-grade zinc concentrate produced from the Cerro de Pasco zinc-lead ore body could be sold for export at a reasonable profit than in the previous 2

[36] Cerro de Pasco Corp., Annual Report, 1955

years. Nevertheless, there was a further incr
stockpile of zinc concentrate during 1955.

Banco Minero del Peru 4 custom concen
active, and construction of the new 70-ton-per
(officially opened, October 23, 1955)[37] was com
active mills were at La Virreyna, Province of C
colpa, Department of Huancavelica; Sacrach
and Hualgayoc, Department of Cajamarca.
of all the Banco Minero concentrators was 1,(

Northern Peru Mining & Smelting Co.
Refining Co. subsidiary) continued to operat
zinc mine and 350-ton mill near Pacasmayo.

EUROPE

Austria.—Bleiberger Bergwerks Union,
company in the Province of Carinthia, was th
mary zinc in Austria in 1955. The company
Bleiberg-Kreuth produced 194,600 short tons
tons was reclaimed from dumps. The flotati
tons of zinc concentrate, with 5,800 tons of m
tons of lead concentrate, with 5,300 tons of ex
In September 1955, the company new electroyl
Arnoldstein went into production. Its annu
to 12,000 tons of zinc, 99.99 percent pure.
zinc in 1955 totaled 1,500 tons; an additional
zinc was produced at the plant from zinc scra

Belgium and France.—No zinc has been r
1946, when the Vedrin mine closed. In Fra
zinc contained in concentrates from severa
11,400 short tons.

Belgian and French smelters together produ
of slab zinc in 1955, compared with 357,800 sh
smelters produced from concentrate obtain
French Africa, Sweden, Australia, Spain, Pe
countries.

The leading producing company was the Soci
et Fonderies de Zinc de la Vieille-Montagne, wit
(including 1 electrolytic plant) and 2 in F
Other smelting companies included the Cie.
Lommel et de Corphalie (2 active smelters), So
de Prayon, and Soc. Anon. de Rothem in Belgi
et Métallurgique de Penarroya and Cie. Royal
(2 smelters) in France.

Finland.—With a full year operation of th
Vihanti mine in central Ostrobothinia, which
November 1954, output of zinc concentrate
10,100 short tons in 1954 to 44,900 tons in 19
Vihanti mine contributed 39,200 tons (averag
and the Metsämonttu mine, another Outokum
5,600 tons (averaging 49.1 percent zinc).
193,200 tons of ore mined from the Vihanti v
0.49 percent copper, and 0.63 percent lead.
shipped outside the country for smelting.

[37] Engineering and Mining Journal, vol. 156, No. 12, December 1955,

Germany, West.—Mines in West Germany produced 101,600 short tons of recoverable zinc in 1955, a 2-percent decrease from 1954. Output declined in midsummer but increased in the latter part of the year. Most of the mines are marginal producers at the lower prices prevailing during 1955. The major zinc- (and lead-) producing areas are the Harz Mountains and the Rhineland, but some mines in southern Germany produced both zinc and lead. The principal mines included the Erzbergwerk Rammlesberg and Erzbergwerk Grund[35] mines in the Harz area and the Auguste Viktoria, Ramsbeck, Maubacher Bleiberg, and Leuderich in the Rhineland.

Smelter production of zinc totaled 197,000 short tons against 184,800 tons in 1954. The 6 active smelters were all retort plants, 1 having the continuous smelting vertical retorts of the New Jersey Zinc Co. type. Imports of zinc ore increased almost 50 percent to 114,300 tons in 1955. The chief suppliers were Peru, Sweden, Italy, and Spain, in the order named. Imports of zinc metal and scrap totaled 75,200 tons compared with 62,900 tons in 1954. Exports increased from 15,500 tons in 1954 to 33,600 tons in 1955. Domestic consumption rose 6 percent to 253,500 tons.

Italy.—Smelter output of zinc in Italy increased 5 percent over 1954 to 77,800 short tons in 1955, and mine production of zinc rose 11 percent to 131,900 tons. Most of the mine output came from the island of Sardinia. The larger producers on Sardinia were the mines of Montevecchio Societa italiana del piombo e dello zinco and Societa di Monteponi. The Sapez Co. of Nossa (part of the Italian Metal Ores Agency, AMMI, a Government-owned corporation) mines produced chiefly calamine ores in Sardinia and at Bergamo on the mainland. Slab zinc was produced by electrolytic plants at Monteponi in Sardinia and at Crotone, Nossa (Bergamo), and Porto Marghera (Venice) on the mainland; and by a retort smelter at Vado Ligure. The capacities and operators of the plants were given in the 1954 Minerals Yearbook Zinc chapter.

Norway.—In Norway the Mofjelletsand and Bleikvassli mines produced 7,200 short tons of zinc (contained in concentrate) in 1955. The electrolytic zinc plant of Det Norske Zinkkompani, A. S., near Odda produced 49,700 short tons of slab zinc.

Poland.—Zinc output in Poland has increased in recent years. According to European press reports, a new Polish electrolytic zinc refinery at Boleslowie began producing at end of May 1955. When fully productive, the plant is expected to double Polish electrolytic zinc output.

Spain.—By far the leading producer of zinc concentrate and the only producer of slab zinc in Spain in 1955 was the Real Compania Asturiana de Minas at its Reocin and Arditurri mines near the north coast and Arnao zinc-retort smelter near Aviles. La Florida mine was discontinued during the year, owing to high production cost. The Penarroya zinc smelter near Cordoba in southern Spain remained idle. Most of Spain's output of zinc concentrate was exported to Belgium, France, Norway, and Holland. Production of zinc metal was 26,200 short tons, an increase of 600 tons over 1954. Total mine production of zinc was 102,000 short tons compared with 97,000 tons

[35] Mining Magazine (London), A Lead-Zinc Concentrator in the Harz Mountains: Vol. 93 No. 5, November 1955, pp. 273, 275–278.

in 1954. The petition of the Minera Celd Cartagena, Province of Murcia, southern Industry for permission to build a zinc January 25, 1956.

Sweden.—Production of zinc concentra short tons in 1955. Swedish concentra countries for smelting; the quantity exporte compared with 121,700 tons in 1954. Pro years were Boliden Mining Co., the Gov gruvor, Falu Kopparverk, and AB Zinkgru

United Kingdom.—Zinc concentrate pro the United Kingdom in 1955 contained 3,2 output came from small lead-zinc mines Wales. Smelters produced a total of 91,10 the same as in 1954) from concentrate impo put of zinc oxide was 41,000 tons. Impo Canada, United States, Belgium, and Aust Consumption of slab zinc was 281,600 ton 5-percent increase over 1954. Exports a totaled about 1,700 tons.

U. S. S. R.—Official data on zinc product not available for 1955, but an estimate is United Kingdom marketed some high-grad during 1955.

Yugoslavia.—Output of zinc contained i Yugoslavia increased 4 percent over 1954 to The quantity of ore mined was 1,818,800 to in Yugoslavia yielded 15,200 tons of slab z in 1954. Exports of zinc concentrate t Trepca group of lead-zinc mines in Serbia Europe) was the leading Yugoslav zinc pro was transported 18 kilometers by aerial tra at Zvecan for concentration. The lead co Zvecan, but the zinc concentrate was smelte zinc mines and flotation mills in Serbia, other places produced a substantial tonnage

The zinc-retort smelter at Celje, Sloveni pacity of 19,800 tons of slab zinc. Work p on the new 13,200-ton electrolytic zinc pla Sabac, Serbia.

ASIA

Burma.—The Burmese output of zinc was lead-zinc mine of Burma Corp., Ltd., in th Burma. During the year ended June 30, 112,400 short tons of ore, which was treat The mill and smelting and refining works are the mine. The ore yielded 14,300 tons of zi tons of refined lead, 1,036,800 fine ounces of matte, 600 tons of nickel speiss, and 400 Immediately before World War II the mine tons of ore a year. The ore reserve was 3,100,000 tons containing 12.5 percent zinc, ounces of silver per ton.

India.—Metal Corp. of India, Ltd., worked the lead and zinc mines at Zawar in Rajasthan and operated a lead smelter at Tundoo. The zinc concentrate containing 2,900 tons of zinc was shipped to Japan for smelting.

Japan.—Although mine production of zinc in Japan declined slightly in 1955, smelter output of slab zinc rose to a record high of 124,036 short tons, compared with the previous high of 111,700 tons in 1954. Mine production (zinc content of ore) was 119,500 tons, compared with 120,500 tons in 1954. Imports of zinc concentrate, mostly from India and Australia, and slab zinc totaled 12,000 and 5,800 short tons, respectively. The principal zinc producers, active mines and smelters, were the Mitsui Metal Mining Co., Ltd., Nippon Mining Co., Ltd., and Mitsubishi Metal Mining Co. Dowa Mining Co., Ltd., an iron- and copper-ore producer, also produced electrolytic zinc. The zinc ores contain some lead and were the source of most of Japan's mine output of lead. Electrolytic zinc was produced by 8 plants and distilled zinc by 2 plants.

AFRICA

Mine production of zinc in Africa decreased 3 percent from 1954 to 221,300 short tons in 1955. A substantial decline in Belgian Congo output more than offset substantial increases in Algeria and French Morocco. Belgian Congo contributed 34 percent of the African total; French Morocco, 22 percent; Northern Rhodesia, 17 percent; Algeria, 15 percent; South-West Africa, 9 percent; and Tunisia (plus a small tonnage from Egypt), 3 percent.

Belgian Congo.—Congo zinc production continued to come solely from the rich copper-zinc ores of the Prince Leopold mine of Union miniére du Haut Katanga at Kipushi. According to published data,[11] the Kipushi concentrator treated 1,198,000 short tons of ore from the Prince Leopold mine in 1955, producing 68,700 tons of concentrate averaging 22.71 percent copper and 257,100 tons averaging 29.02 percent copper; and 125,800 tons of zinc concentrate averaging 59.59 percent zinc. A large part of the zinc concentrate was roasted in the Sogechim works at Jadotville to produce sulfuric acid. Some of the calcined concentrate was sold to the METALKAT electrolytic zinc plant at Kolwezi and some was shipped to Belgium for smelting. The METALKAT plant, at near capacity, produced 37,500 tons of exportable ingots, compared with 35,300 tons the previous year. Exports of zinc concentrate, however, dropped from 132,900 tons to 113,600.

French Africa.—Mines in French Africa produced 40 percent of Africa mine output of zinc in 1955 compared with 32 percent in 1954.

French Morocco output of zinc concentrate was 86,000 short tons (metal content, 47,700 tons) in 1955, compared with 69,300 tons in 1954. Stocks at the end of 1955 were 12,100 tons. Exports of zinc concentrate (according to customs statistics) were 89,900 tons to France, 5,100 tons to Netherlands, 2,400 tons to West Germany, 1,700 tons to Belgium-Luxembourg, and 11 tons to Algeria. The Bou Beker mines group of the Société des mines de Zellidja continued to be the leading Moroccan producer of zinc (and lead also). The

[11] Metal Bulletin (London), No. 4108, July 6, 1956, p. 14.

group is in eastern Morocco 25 miles sout
border. The Touissit properties of the Co
des Mines just south of the Bou Beker ra
other mines contributed to the output of

Nearby but across the border in Alge
increased. The Société Algerienne du
Zellidja) continued to be an important pr
trated in a 1,000-ton-capacity gravity con
mine on the Moroccan side of the borde
produced substantial quantities of zinc
duced was shipped to plants in Europe f

The El-Akhouat and Sakiet-Sidi-Yous
duced 10,800 short tons of zinc sulfide c
tons of zinc. The mines are said to be
price higher than that prevailing in 195

Rhodesia and Nyasaland, Federation
Development Co., Ltd., in northern Rhod
of zinc in the Federation. Mining activ
the zinc-lead mine and mill, lead smelter,
Both oxide and sulfide ores were mined.
in 1955 was the largest in the history of th
duction, at 31,200 short tons was 1,500 t
refined lead at 18,000 tons, was 1,100 ton

South-West Africa.—Tsumeb Corp., Lt
Mining Corp. and American Metal Co.,
copper-zinc mine and flotation mill at Ts
in concentrate, which was exported to Bel
for smelting. The concentrates produced
lead-copper concentrate and 42,800 tons
milled totaled 595,000 tons. Total meta
exported in 1955 were: Zinc, 23,200 short t
copper, 23,600 short tons; cadmium, 700
and silver, 1,279,200 ounces.

OCEANIA

Australia.—Australian mine output of
in 1955, was larger than in any previous y
tion increase over 1954 was less than 2 pe
2 preceding years brought about a total
over 1952. Costs of production rose as
in wages and salaries. Technological im
ore treatment, were an important factor
Production of refined zinc was 113,200 ton
because of reduced power supply at the
Tasmania.

The principal producing mining distri
Captain's Flat in New South Wales, Cl
in Queensland, and Read-Rosebery in Ta
district with 4 large zinc-lead-silver mines
than two-thirds of Australia's total mine
Broken Hill Consolidated, Ltd., mined 5

1955,[40] averaging 8.9 percent lead, 13.8 percent zinc, and 2 ounces of silver per ton. Of the total ore treated, 383,600 tons was handled in the company-owned mill, and 187,564 tons was treated in the Zinc Corp., Ltd., mill. Ore reserve at the end of 1955 was 3 million tons against 2.8 million tons in 1954. Zinc Corp., Ltd., mined 731,400 tons of ore [41] yielding 93,500 tons of lead concentrate, 131,000 tons of zinc concentrate, and 1,833,000 ounces of silver.

Broken Hill South, Ltd., (Broken Hill south and Barrier Central properties) milled 435,300 short tons of crude ore yielding 72,100 tons of zinc concentrate and 59,400 tons of lead concentrate (carrying 39 ounces of silver to the ton) during the fiscal year ended June 30, 1955, according to the company annual report. North Broken Hill, Ltd., was also a large producer of zinc, lead, and silver.

In the Captain's Flat district, Lake George Mines (Pty.), Ltd., resumed its zinc-lead-copper mining on February 1 after more than a 7-month shutdown caused by a labor dispute. As all but 5 days of the shutdown occurred in the company fiscal year ended June 30, 1955, output of ore in that fiscal year was only 61,400 tons, compared with 196,300 tons in the preceding fiscal year. Ore milled in the 1955 fiscal year averaged 10.4 percent zinc, 6.02 percent lead, and 0.64 percent copper.[42]

In North Queensland, Mount Isa Mines, Ltd. (52-percent-owned by American Smelting & Refining Co.), continued mining its copper-lead-zinc-silver group, 2,000-ton concentration mill, and copper and lead smelters at Mount Isa. Output of metals during the fiscal year ended June 30, 1955,[43] aggregated 3,648,000 ounces of silver, 47,700 tons of lead, 20,900 tons of zinc, and 25,000 tons of copper, which were extracted from a total of 1,393,500 tons of ores treated.

In the Read-Rosebery district, Tasmania, mines of Electrolytic Zinc Co. of Australasia, Ltd., produced 203,100 short tons of ore in the fiscal year ended June 30, 1955, compared with 212,100 tons in the preceding fiscal year, according to the company annual report (No. 35). The ore yielded 58,200 tons of zinc concentrate, 9,900 tons of lead concentrate, and 7,500 tons of copper concentrate. The zinc concentrate was shipped to the company Risdon electrolytic-zinc plant, and the lead and copper concentrates were exported.

The Risdon zinc plant ran continuously throughout the fiscal year but not at full capacity at all times owing to restriction of electric power supply. Production of slab zinc was 112,600 short tons, compared with 111,100 tons in the fiscal year 1953–54. Production of cadmium was 200 tons. Sales of zinc were 68,500 tons to Australian consumers and 37,700 tons to consumers in India, United Kingdom, United States, and New Zealand. Construction of the third flash roaster and much of the ancillary equipment, including that for treatment of gases and handling of roasted products, was completed. This plant was brought into schedule early in 1955. Construction of a fourth flash roaster was begun just before the close of the year. Arrangements were made during the year for the long-term purchase of zinc concentrate from North Broken Hill, Ltd.; Broken Hill South, Ltd., Zinc Corp., Ltd., and New Broken Hill Consolidated, Ltd.

[40] Metal Bulletin (London), No. 4100, June 8, 1956, p. 21.
[41] Mining World, vol. 18, No. 3, March 1956, p. 73.
[42] Metal Bulletin (London), No 4059, Jan. 10, 1956, p. 20.
[43] American Smelting & Refining Co., Fifty-Seventh Annual Report, for the Year Ended December 31, 1955.

Zirconium and H

By Kenneth B. Higbi[1]

ZIRCONIUM and hafnium are closely conium minerals usually contain a sma Their separation is relatively difficult tunately is not necessary for many uses. Pr complete responsibility for zirconium-metal Carborundum Metals Co., Inc., with faci operated at capacity and exceeded its Ato (AEC) contract commitment for the metal. was available for increasing civilian appl producer of commercial and reactor-grade Mines zirconium production plant in its N ment Laboratory, Albany, Oreg., shut dow determined that zirconium stocks and curr could temporarily supply its needs. Some of facilities were converted to research and the r tion for resumption of zirconium production sary.

Hafnium production also increased in 1955 as a byproduct from the processing of hafniu

Zirconium metal was an expensive laborat when development work on the Kroll magn was begun by the Bureau of Mines at its N ment Experiment Station, Albany, Oreg. B liminary results, in February 1947 a pilot plan of 60 pounds of zirconium sponge began ope duced about 4,500 pounds of zirconium spong was melted and fabricated into sheet metal. obtained from this plant, production facilitie in cooperation with the AEC and the Navy B plant having a capacity of 500 pounds a w June 1949 and a larger plant in May 1950 enlarged in January 1951 and was again ex to a final rated capacity of 275,000 pounds of annually.

About 6,000 pounds of hafnium-sponge m annually as a byproduct of zirconium produc

Meanwhile in 1949 scientists at the Y–12 pl Chemicals Corp., at Oak Ridge, Tenn., ha

[1] Commodity specialist.