

Minerals Yearbook 1968

Volume I—Iron

METALS, MINERALS,



Prepared by staff of
BUREAU OF MINERAL INVESTIGATION

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Liberia.—A report published by the Liberian Geological Survey described the Mount Montro Kyanite Deposit, Grand Bassa County.³ The deposit, a large single body in a belt approximately 12,600 feet long, 480 feet wide, and from 25 to 350 feet thick, has a kyanite content ranging from 10 to 35 percent. Total reserves were estimated at about 10 million tons of kyanite rock containing about 2.5 million tons of kyanite.

South Africa, Republic of.—Sillimanite production for the first 9 months of 1968

was 27,663 tons with output indicated to be slightly lower than that of 1967. Andalusite production for the same period was 18,826 tons, and if the trend continued for the rest of the year, would indicate a considerable decline below 1967 production. For this 9-month period, about 70 percent of the total output was exported. In 1967, the last full year for which data are available, sillimanite output was 39,005 tons, a slight increase over 1966 output. Andalusite production rose to 27,098 tons compared with 23,684 tons for 1966.

TECHNOLOGY

Bureau of Mines research showed the applicability of heavy liquid separation techniques for recovery of concentrates from minus 35-mesh ore samples of kyanite, potash, spodumene, fluor spar, and beryl.⁴ Known resources of high-temperature refractory raw materials in the Pacific Northwest were substantially increased by the completion of Bureau of Mines field and laboratory studies of kyanite group mineral deposits. A study of present and potential domestic and foreign markets for western kyanite will be published in 1969.

The calcination and sintering behavior of three samples of Alabama bauxitic material was studied in the laboratory.⁵ At 2,700°F the densification of the three samples—two mainly of mullite and siliceous glass, and the third mullite and cristobalite—stopped and the pellets reached their maximum bulk specific gravity.

The first American edition of a comprehensive British report on the sillimanite

group minerals and synthetic mullite was published.⁶ The work describes the minerals, refractory qualities and specifications, information on deposits throughout the world (including reserves where available), mining and processing methods, world trade, prices and uses. In addition to a discussion of synthetic mullite production, an extensive bibliography broken down into major subject headings is included.

³ Stanin, S. Anthony, and Blismark R. Cooper. The Mount Montro Kyanite Deposit, Grand Bassa County, Liberia. Republic of Liberia, Bureau of Natural Resources and Surveys, Geological Survey. Bull. No. 2, 1968, 20 pp.

⁴ Tippin, R. B., and James S. Browning. Heavy Liquid Cyclone Concentration of Minerals (in Two Parts).

⁵ Bakker, Walter T. General Refractories Research Project Reveals Higrade Domestic Bauxite. Brick and Clay Record, v. 153, No. 7, August 1968, pp. 24-26.

⁶ Varley, E. R. Sillimanite (Andalusite, Kyanite, Sillimanite). First American Edition. Chemical Publishing Co., Inc., New York, 1968, 165 pp.

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Lead

By Donald E. M

The world lead industry achieved a record level of production and consumption in 1968. World mine production indicated at 3.31 million tons was closely aligned with metal production at 3.22 million tons, a significant upward surge of 4.4 percent from the 1967 level. The free world mine production of 2.44 million tons and smelter production of 2.38 million tons did not satisfy the indicated 5.3-percent increase in metal consumption. Producer stocks, after a buildup in midyear to some 204,000 tons at the end of July, ended the year at 163,000 tons, about 18,000 tons below that existing at the end of 1967. The foreign lead price reflected the tightening supply situation with a gradual rise in the monthly

Table 1.—Salient lead

	1964
United States:	
Production:	
Domestic ores, recoverable lead content.....short tons..	286,010
Value.....thousands..	\$74,936
Primary lead (refined):	
From domestic ores and base bullion.....short tons..	294,264
From foreign ores and base bullion.....short tons..	155,175
Antimonial lead (Primary lead content).....short tons..	8,607
Secondary lead (Lead content).....short tons..	541,582
Exports of lead materials excluding scrap.....short tons..	10,194
Imports, general:	
Lead in ores and matte.....do....	123,257
Lead in base bullion.....do....	4,838
Lead in pigs, bars, and old.....short tons..	212,898
Stocks December 31 (lead content):	
At primary smelters and refineries.....short tons..	84,398
At consumer plants.....do....	119,444
Consumption of metal, primary and secondary.....short tons..	1,202,138
Price: New York, common lead, average, cents per pound.....	13.62
World:	
Production:	
Mine.....short tons..	2,779,182
Smelter.....do....	2,818,265
Price: London, common lead, average, cents per pound.....	12.59

Reported domestic consumption, marked by a record output of storage batteries and gasoline additives, established a new high of 1.33 million tons, almost $5\frac{1}{2}$ percent above the 1967 total and slightly above the previous high of 1.32-million tons set in 1966. Despite the increase in smelter metal and the continued high level of metal imports and secondary metal, stocks were depleted and all of the Government stockpile lead authorized for disposal was sold by early April. The available lead supply for the year, (production, imports, secondary stock changes and exports) indicated a disappearance of some 92,000 tons of lead in addition to the 1.32 million tons reported as consumed, well above the indicated disappearance in recent years.

The domestic price of lead, stable at the 14 cents per pound level established on October 10, 1966, was decreased to 13 cents on May 2, 1968, and $12\frac{1}{2}$ cents on July 15, reflecting the expected supply surplus after settlement of the 9-month strike in April, and also a slight buildup of stocks during the normal vacation doldrums of July and August. Continued high consumption, both domestic and foreign, and strike diminished supply, however, resulted in a stock drawdown and on October 11 a price increase to 13 cents per pound was initiated and joined by all producers on October 14.

The situation at the end of the year was one of high demand, stocks amounting to less than 1 month's consumption, no stockpile lead authorized for sale, and a rising European price of 11.3 cents per pound, well above the normal $2\frac{1}{2}$ to 3 cents per pound comparative domestic differential.

Legislation and Government Programs.—The price of lead throughout 1968 was below the 14.5 cents per pound floor under which payments to eligible domestic producers are authorized by "The Lead and Zinc Mining Stabilization Program," Public Law 89-239. Payments in 1968 amounted to \$98,889 on 5,876 tons of lead. Under the revised regulations, published June 1, 1966, 60 producers of the 142 applying were certified. Under this program initiated in October 1961, total payments on 36,801 tons of eligible lead have amounted to \$1,251,618 and on combined lead and zinc \$2,520,023. Oklahoma and Utah had the largest number of active participants in

the program, each with 24, although Oklahoma has received the largest payment, amounting to 43 percent of the total.

Government participation in exploration, primarily for lead, was withdrawn in June 1962. The program, under the Office of Minerals Exploration, Department of the Interior, continued active in other base metals—antimony, bismuth, copper, gold, and silver. These metals are often in association with lead and the national lead resource is benefited by the work performed with government assistance.

Sales of Government stockpile surplus lead under Public Law 89-9 enacted in March 1965, was conducted by General Services Administration on an open-sale, shelf-item basis until early April. Sales were terminated at that time upon completion of the 150,000 tons total authorized for commercial sale. Sales amounted to 26,460 tons and deliveries to 28,677 tons for the calendar year, thus reducing the Government inventory to 1,164,603 tons of refined lead valued at \$302.8 million. The Government inventory also contained an additional 10,336 tons of antimonial lead valued at \$3.1 million.

The International Lead and Zinc Study Group held its 12th session in Geneva, Switzerland, on November 18-22, preceded on November 13-15 by meetings of various committees concerned with statistics, form and estimates of production and consumption, and factors influencing trade in lead and zinc. Representatives of 27 countries attended the session, including the Republic of Zambia and the Hungarian Peoples Republic which were formally accepted into membership. The Study Group noted the lower than expected mine and metal production, the import of some 55,000 tons of lead from free world markets by China, and a rise of about $5\frac{1}{2}$ percent in metal consumption. The conclusion of the statistical committee was a supply shortfall of 20,000 tons in 1968 and an indicated statistical supply surplus in 1969.

The International Lead-Zinc Research Organization, incorporated in 1965 by 26 charter member companies, has grown to 31 companies in 11 countries representing the majority of the world's lead and zinc production. The organization continued to sponsor research and development programs related to basic data and applications for lead and zinc products.

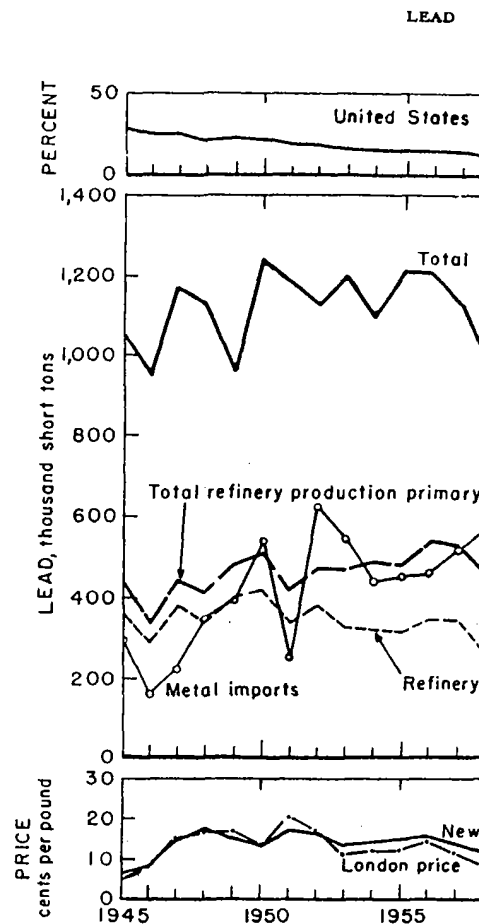


Figure 1.—Trends in the lead industry, 1945-1955.

DOMESTIC PRODUCTION

MINE PRODUCTION

Mine production was curtailed during the first quarter of the year by the continuation of the strike closure of mines in the Western States and inability of other mines to market concentrates due to smelter closures. Operations were resumed in April at most of these mines but normal production levels were not achieved until June. The first 6-month output thus totaled 147,500 tons in comparison to 168,900 tons in the like period of 1967. Production

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United Park City and Tintic mines in Utah. The continuing shortage of labor, and particularly experienced miners, has affected production and development in most of the domestic mining areas.

Missouri mines accounted for almost 60 percent of the domestic production compared with 48 percent in 1967, followed by Idaho, 14 percent; Utah, 13 percent; and Colorado, 6 percent. These four States contributed 93 percent of the domestic output of recoverable lead in ore and the 25 leading mines listed in table 5 produced 93 percent of the recoverable lead.

Southeast Missouri continued to be the world's most active lead producing area. St. Joseph Lead Co. continued production at the Federal, Indian Creek, Viburnum, and Fletcher mines and concentrators and produced 259,500 tons of lead concentrates in comparison with 220,100 tons in 1967. The new Goose Creek shaft was completed and in production with ore from this development processed at the Indian Creek concentrator. The large, mobile equipment in use at the Fletcher mine has achieved production rates almost six times the maximum level attained with 1958 equipment and methods.³ This has resulted in positioning the Fletcher as the leading domestic lead mine. The Magmont mine, a joint venture of Cominco American Inc., and Dresser Industries, Inc., was brought into production in midyear and will be at its full capacity of 50,000 tons of lead in concentrates by mid-1969. Reserves at this mine are estimated at 15 million tons of ore containing 1.3 million tons of lead and zinc.⁴ The startup of the Missouri Lead Operating Co., a joint venture of American Metal Climax Inc. and Homestake Mining Co., was delayed by extensive underground water flow but was expected to be operational early in 1969. Reserves at this mine are stated to be 53.6 million tons of ore averaging 6 percent lead and zinc.⁵ Ozark Lead Co., a subsidiary of Kennecott Copper Corp., continued development at the Ellington mine but was delayed by the strike and lack of experienced personnel.⁶

Development and exploration in the Coeur d'Alene area of Idaho continued to the extent of labor availability. Participation agreements involving American Smelting and Refining Company, Day Mines Inc., Hecla Mining Co., The Bunker Hill Co., and various other property owners have permitted extensive programs of ex-

ploration and development in depth in areas adjacent to the Galena mine, Lucky Friday mine, and Sunshine mine. Shaft sinking and development at the Lucky Friday, Sunshine Unit area and Star-Morning Unit area was underway at depths ranging down to the 7,300-foot level at the Star-Morning. The Galena mine resumed operations in April and the Lucky Friday on June 15 after strike closure for 8 months. Operations at The Bunker Hill Co. mines and those operated by Day Mines Inc. were not affected by the strike in 1968.

The Utah mines were also affected by the strike and by a shortage of labor which reduced production. The Midval Flotation Mill, operated by United States Smelting, Refining and Mining Co., was idle for several short periods during the first 4 months, due to shortage of ores from shippers, and stockpiled lead concentrates until resumption of operation at the Tooele, Utah smelter.⁸ The Burgin mine of Kennecott Copper Corp. virtually completed construction of a concentration plant and mine expansion from 500 to 800 tons per day. A new shaft to extend the mining area was started in June.

The Idarado mine of Newmont Mining Corp. in Colorado operated all year with a slightly lower output of ore and metal compared with 1967 and development of ore reserves was slightly below ore produced. Development by Resurrection Mining Co. at Leadville, Colo., a joint project of Newmont and American Smelting and Refining Company, has indicated reserves of 2.4 million tons of ore with an average of 5.13 percent lead, 9.95 percent zinc, and 2.65 ounces of silver per ton.⁷

The Pend Oreille Mines & Metals Co. operated the Pend Oreille mine on a more selective mining program and while tonnage was reduced 32 percent, lead produced in concentrates was almost three times larger than in 1967.⁹

SMELTER AND REFINERY PRODUCTION

Primary plant production of lead metal amounted to 495,900 tons, an increase of 24 percent compared with the 1967 figure. The strike at plants operated by American Smelting and Refining Company and International Smelting & Refining Co., which began in July 1967, extended through March, but operations were finally resumed in April after settlement. In January production amounted to 18,100 tons, the lowest output since November 1959. A high level of output was, however, regained in March because of the accumulation of lead concentrates at some mines and custom mills during the strike.

The Herculaneum smelter of St. Joseph Lead Co., after a short shutdown in January to effect repair and adjustment after the smelter expansion completed in 1967, produced a record 170,799 tons of refined lead and lead in alloys and again was the leading domestic plant. A sulfuric acid plant was under construction to utilize gases from the smelter.⁹

The Buick, Mo., smelter operated by Missouri Lead Operating Co., a joint subsidiary of American Metal Climax, Inc., and Homestake Mining Co., began initial operations in August on concentrates from the Magmont mine at Bixby, Mo., a 50,000-ton-annual-capacity mine-mill complex owned by Cominco American and Dresser Industries. Production proceeded until November 6 when closed by a strike of the United Steelworkers Union. Settlement was reached on November 20 on a 3-year labor contract and production resumed.¹⁰

American Smelting and Refining Company's new Glover, Mo., smelter was completed and limited production initiated in July. A strike, however, closed the plant on September 10 after limited shipments were made and operations were not resumed in 1968.¹¹ The East Helena, Mont., El Paso, Tex., and Selby, Calif., smelters were operated after settlement of the strike and the lead bullion refined at Omaha, Neb., and Selby, Calif.

The lead smelter and refinery at Kellogg, Idaho, operated by The Bunker Hill Co., a subsidiary of Gulf Resources and Chemical Corp., operated at capacity and produced 1.5 percent more metal than in 1967, thus, continuing an expansion in output initiated in 1965. A new updraft sintering

³ St. Joseph Lead Co. Annual Report, 1968, p. 9.

⁴ Cominco Ltd. Annual Report, 1968, p. 9.

⁵ American Metal Climax Inc. Annual Report, 1968, p. 13.

⁶ Kennecott Copper Corp. Annual Report, 1968, p. 12.

⁷ United States Smelting, Refining and Mining Co. Annual Report, 1968, p. 11.

⁸ Newmont Mining Corp. Annual Report, 1968, p. 8.

⁹ Pend Oreille Mines & Metals Co. Annual Report, 1968, pp. 4-5.

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¹⁰ St. J p. 9. ¹¹ Ame 1968, p. ¹² Ame Annual ¹³ Gulf Report. ¹⁴ Unit Co. Ann

rial, 1,400 tons was scrap, and 45,200 tons was in intermediate process materials. Total stocks increased to 162,000 tons at the end of March but upon resumption of operations at the strike-closed smelters decreased to 125,000 tons at the end of July and then gradually increased to 139,100 tons at yearend, of which 85,200 tons was primary raw material, 2,000 tons was scrap, and 52,000 tons was in process.

Consumption of scrap materials amounted to 725,700 tons, gross weight, in comparison to 726,300 tons in 1967. Battery scrap, however, represented 64 percent in comparison to 62 percent in 1967 and 60 percent in 1966. Recycled drosses and residues increased to 104,000 tons in comparison with 101,100 tons in 1967 and amounted to 14 percent of the secondary

materials consumed. Receipts of scrap and consumption were balanced for the entire year. The monthly trend, however, indicated the relationship of weather to receipts of scrap, particularly battery scrap. Stocks increased 7.3 percent in January, 1.1 percent in February and March, and then declined 3.6 percent in April, 10.9 percent in May, were balanced in June, increased 9.2 percent in July (the smelter vacation period), and then decreased about 4 percent monthly until December when stocks increased 12.7 percent. The increasing number of gasoline- and battery-powered units on the highways, airways, and waterways, and in industrial use indicates a promising future supply of worn-out batteries for reprocessing into secondary lead.

CONSUMPTION AND USES

Lead consumption recovered dramatically in 1968 to a new record of 1.33 million tons, an increase of 5.4 percent in comparison to the low level of 1967 and almost 5,000 tons above the previous high reported for 1966. The combined record production of batteries and gasoline antiknock compounds, which are dependent on lead, stimulated the increased demand. Examination of domestic supply sources indicated that metal production, imports, stock changes, and Government disposal during 1968 totaled some 92,000 tons of lead above that accounted for in reported distribution. This disappearance was well above that indicated in recent years and presumably was unreported domestic consumption or stock buildup. Consumption was quite evenly spread throughout the year with the historical low again in July and the historical high in October. The 133,100 tons used in October appeared to be a record exceeding the 126,600 tons in October 1950. The daily average of 3,641 tons compares with 3,453 tons in 1967 and 3,627 tons in 1966.

The lead consumed in metal products, other than batteries, was 364,300 tons, almost identical to that used in 1967. Increases posted for ammunition, brass and bronze, calking lead, piping, sheet and solder, were balanced by decreases in bearings, cable covering, casting, collapsible tubes, foil,terne, and type metal. Ammunition continued the upward trend since 1963 reflecting increased military require-

ments. Brass mills resumed operation in April after the prolonged copper industry strike which reduced requirements in 1967. Increased calking lead, piping, and sheet consumption indicated the high level of construction, as did the use of lead in vibration and sound control. Areas of diminishing requirements were, in general, in accord with the downward trend established in recent years in these historical applications.

The manufacture of lead-acid storage batteries required a record 514,000 tons, approximately 39 percent of the total and 47,000 tons above that used in 1967. The annual growth of lead used in batteries has averaged over 5 percent since 1958. The battery industry enjoyed a record-breaking year in 1968 according to statistics of the Association of American Battery Manufacturers, Inc. A total of 46.5 million automotive-type batteries were shipped, consisting of 35 million replacement batteries, 11 million installed in new vehicles and 418,300 exported. The replacement battery shipments were almost 7 percent above the previous high in 1963 and original equipment was last exceeded in 1965 while exports were the largest since 1952. This large increase reflected the growing number of motor vehicles registered which approached 97 million at the end of 1967, and included the replacement of original equipment in cars produced in the record year of 1965, and new vehicles produced in 1968, the second highest production in

history. The indicated life of a battery in 1967, based on vehicle registration and replacement shipments, was 28.6 months, a continuation of the upward trend since 1963. In addition to the automotive-type batteries, the use of larger capacity industrial batteries steadily increased and required 10 to 15 percent of the total lead in batteries.

The use of lead in antiknock compounds was also at a record 261,900 tons, almost 6 percent above the 1967 use and reflects the increasing mileage driven by gasoline-powered vehicles. The annual growth of lead use, interrupted by the jet fuel replacement of aviation gasoline, has averaged almost 5 percent since 1958 and essentially parallels the growth in battery lead.

The automotive requirements for lead in the near future indicate a continuing upward trend in consumption which will outweigh the stable or declining use of lead in some of its historic uses such as piping, type metal, bearings, cable covering, and paints which are being replaced by competitive materials and/or technological change. The use of lead in vibration and noise control is a promising development and the intensive research and development by industry and the International Lead and Zinc Research Organization is indicative of the effort expended to maintain the competitive position of lead in historical use areas as well as participate in new technological developments for metals.

LEAD PIGMENTS

Lead required for production of pigments and oxides increased to 345,500 tons, all derived from pig lead except 1,500 tons in leaded-zinc oxide from ores. Requirements for white lead and red lead continued to decline and represented only 8.4 percent of the total compared with 10 percent in 1967. Consumption in oxides registered major gains—20 percent for litharge and 7 percent for black oxide—as storage battery output using a large percentage of the oxides reached record levels.

The paint industry used a slightly smaller tonnage of white lead in 1968 and the sharp downward trend in recent years appears to have been stabilized. Various uses not itemized also decreased moderately. Red lead in paints decreased 15 percent while miscellaneous uses held steady in comparison to the year 1967.

oxide imports amounted to 200 tons valued at \$44,300, principally from West Germany followed by Mexico, France, and Canada. Litharge was the largest lead pigment material received amounting to 24,800 tons valued at \$5.13 million and Mexico supplied 97 percent and France 2 percent of the total. Red lead imports amounted to 4,400 tons valued at \$977,000 with Mexico providing 57 percent, France 25 percent,

West Germany 13 percent, and Belgium-Luxembourg, Netherlands, Poland, and Ceylon the remaining 5 percent. White lead imports totaled 2,160 tons valued at \$672,400 with the Netherlands, West Germany, and Canada the leading suppliers with 90 percent of the total. Approximately 6 tons of miscellaneous lead pigments valued at \$8,200 completed the imports of semiprocessed lead materials.

STOCKS

Lead inventories in the hands of producers and consumers were uncomfortably low throughout the year and represented, at the most, a month's consumption. Primary producer stocks of refined lead and antimonial lead combined, totaled 23,400 tons at the beginning of the year and were reduced to 13,200 tons by the end of the first quarter. A buildup in the second and third quarter brought the combined total to 29,600 tons at the end of August and thereafter a sustained drawdown resulted in the total of 15,300 tons at the end of 1968. Total stocks of lead material physically at primary plants was reported to be 90,400 tons at yearend in

comparison to 125,500 tons at the end of 1967. The American Bureau of Metal Statistics reported additional material in transit and a total of 161,900 tons.

Consumer stocks, including secondary smelter stocks, were also drawn down in the first quarter and then rebuilt to 116,000 tons at the end of July. The heavy drawdown in the third and fourth quarter brought the closing stocks to 88,900 tons. Government inventory of lead in stockpile was reduced 28,700 tons during the year with a resulting 1,164,600 tons remaining in refined lead and 10,300 tons of antimonial lead.

PRICES

The last change in the price of lead prior to 1968 occurred on October 10, 1966, when a decrease from 15 to 14 cents per pound at New York, became effective. The price remained stable at 14 cents throughout the strike at Western smelters and a favorable differential of 3.5 to 4 cents per pound of the domestic price in comparison to the London Metal Exchange brought increased metal imports into the domestic market.

Upon resumption of operations after the strike on a high output level, anticipation of a continued high import and additional output from the new Missouri smelters, the price was reduced on May 2 to 13 cents per pound and again on July 15 to 12½

cents per pound. The heavy demand in the third quarter and startup problems in Missouri, however, resulted in a price rise on October 11 to 13 cents which became firm on October 14 and continued through the remainder of the year.

The Canadian price closely followed the domestic price declining from 14 cents to 13 cents during the May-September period and increasing to 13½ cents in October. The London Metal Exchange average monthly price, however, moved steadily upward from a 9.95-cent-per-pound average in January, U.S. equivalent, to a 11.41-cent average in September and after a decline in October increased to an average of 11.35 cents for December.

FOREIGN TRADE

The export market for lead improved in 1968, both in tonnage of refined and in scrap materials, although value was slightly lower in both classes of material. The most significant changes were the large increase

in shipment of refined lead to the South American and European areas and also the European demand for lead scrap.

General imports of lead in ores during the first half of the year were at a very

low level due to the curtailed operations of domestic smelters and a stockpile of domestic concentrates. The total ore and bullion for domestic processing, 88,000 tons for the year, was the lowest amount landed since 1951. Metal imports, amounting to 338,100 tons, was below that received in 1967 and reflected demand for foreign lead resulting from the strike-curtailed domestic refinery output in the first quarter of 1968.

Ores entered for consumption, duty paid, from Australia, Canada, and Honduras were considerably less than the total general import while Peru entries were approximately double the amount delivered as general imports. The lead in ores imported for consumption in 1968 thus amounted to 96,900 tons, a decrease of 33

WORLD REVIEW

Statistical summaries of world production and consumption of lead compiled by the Bureau of Mines, American Bureau of Metal Statistics (ABMS), and the International Lead and Zinc Study Group vary in reporting base, reporting sources, and scope of estimating. The Bureau of Mines reports indicate the basis, insofar as possible, used for each country whereas the Study Group reports on an ore content basis. Therefore, free world mine production in 1968 ranged from the ABMS total of 2.39 million tons through the Bureau of Mines total of 2.44 million tons to the Lead and Zinc Study Group total of 2.48 million tons. In addition, the Bureau of Mines estimated production in the communist areas, other than Yugoslavia, to be 870,100 tons and the world total is thus 3.31 million tons in comparison to 3.17 million tons in 1967, an increase of 4.2 percent. Smelter output also varies widely with the Bureau of Mines reporting, insofar as possible, primary metal while the Lead and Zinc Study Group reports metal output from both primary and secondary sources. Free world smelter output in 1968 thus ranged from the 2.38 million tons reported by the Bureau of Mines through the ABMS total of 2.59 million tons, to the Lead and Zinc Study Group total of 3.18 million tons. An additional 858,000 tons of smelter output was estimated by the Bureau of Mines for the communist countries, other than Yugoslavia, to provide a 3.2-million-ton world primary smelter produc-

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European primary production was indicated to be slightly lower than in 1967 with significant declines in West Germany, Belgium, and Italy more than offsetting the increased output in Spain and the United Kingdom. Communist output, including Yugoslavia, was also indicated to be slightly reduced. An increase in Zambia and Morocco was also more than countered by the decline in smelter output in the Territory of South-West Africa. Japan posted an increase of almost 10 percent in 1968 and has shown an annual growth of 14 percent since 1964. Australian production of refined lead decreased 17,600 tons due to shortage of concentrates from the labor-curtailed Broken Hill mines while bullion production from Mount Isa increased to a new high.

Consumption of metal in the free world in 1968 as reported by the Lead and Zinc Study Group preliminary totals was 3.23 million tons of which the United States accounted for 37 percent. Six countries—France, West Germany, Italy, United Kingdom, Japan, and the United States—used over 100,000 tons and together accounted for 69 percent of the total. Compared with the 3.18 million ton free world metal production reported by the Lead and Zinc Study Group, the supply deficit amounted to 50,000 tons in 1968 and was met by a 14,900-ton reduction in producers stocks, U.S. stockpile sales, and consumer stocks reduction.

Argentina.—Compañía Minera Aguilar, S.A., a subsidiary of St. Joseph Lead Co., milled approximately the same tonnage as in 1967 despite the operational problems of a mill expansion program, and produced for sale on the Argentine market 31,100 tons of lead concentrates.

Australia.—Production at Broken Hill mines was again affected by labor disturbances which resulted in a significantly lower production of lead concentrates and a decrease in refined lead production at the Port Pirie smelter.

Mount Isa Mines Ltd., 53 percent owned by American Smelting and Refining Company, increased lead production from 71,800 tons to 99,200 tons in the year ending June 30, 1968. The completion of crushing facilities and related ore passes for the new K-57 shaft during the year permitted use of the U-52 shaft exclusively for lead-zinc ore production. Installation

of new equipment in the lead smelter was also completed.¹⁵

Canada.—Canadian production increased over 6 percent as Pine Point Mines Ltd. in British Columbia and Ecstall Mining, Ltd., in Ontario, a wholly owned subsidiary of Texas Gulf Sulphur Co., continued to expand output and Nigadoo River Mines Ltd., New Brunswick; Share Mines & Oils, Ltd., Saskatchewan; and Western Mines Ltd., British Columbia, completed this first full year's production.

Cominco Ltd., including its subsidiary Pine Point Mines Ltd., remained the dominant lead producer with an output of 199,300 tons in ore and production of 190,300 tons of refined lead at the Trail, British Columbia, smelter. The Sullivan and Bluebell mines contributed 41 percent of concentrates, 50 percent came from the Pine Point mine, 3 percent from other mines, and 6 percent from purchased slags and residues.

High-grade ore shipments from Pine Point accounted for 47 percent of the sales revenue in 1968 and were terminated in mid-December with exhaustion of presently available high-grade ore reserves. At year-end the orebody acquired from Pyramid Mining Co., Ltd., was ready for production and the addition to the Pine Point concentrator to treat this ore was completed and under full scale testing. Reserves at the Sullivan, Bluebell, and H. B. mines were estimated at 69 million tons containing 7.6 million tons of lead-zinc and reserves at the Pine Point mine estimated at 39.3 million tons containing 3.7 million tons of lead-zinc.¹⁶

Anvil Mining Corp., Ltd., continued stripping of overburden from the open pit lead-zinc mine in the Yukon with 50 percent of the preproduction stripping and construction of a 5,500-ton-per-day concentrator completed. Initial production is scheduled for late 1969 at an annual rate of 130,000 tons of 69-percent-lead concentrates. Reserves are estimated at 63 million tons averaging 9 percent lead-zinc.

The Kidd Creek mine of Ecstall Mining, Ltd. near Timmins, Ontario, increased ore production to 3.6 million tons and lead concentrate production to 96,000 tons.

¹⁵ American Smelting and Refining Company. Annual Report, 1968, pp. 6-7.

¹⁶ Cominco, Ltd. Annual Report, 1968, pp. 8-11.

Brunswick Mining and Smelting Corp., Ltd. milled 1.7 million tons from the No. 12 mine averaging 8.56 percent zinc and 3.38 percent lead with a production of 119,500 tons of lead concentrates. The No. 6 mine output was almost 1 million tons averaging 5.66 percent zinc and 2.47 percent lead, from which 46,330 tons of lead-zinc concentrate and 38,830 tons of lead concentrate were recovered. Reserves of ore at the two mines are estimated at 78.6 million tons. The East Coast Smelting and Chemical Co., Ltd., a subsidiary of Brunswick Mining and Smelting Corp., completed the first full year's operation of an Imperial Smelting Process plant at Belledune, New Brunswick.

Heath Steele Mines Ltd., 75 percent owned by American Metal Climax, Inc., increased ore production from its lead-zinc mine as a result of active mine development and shaft sinking program. The Buchans Unit of American Smelting and Refining Company in Newfoundland operated at capacity throughout the year and produced 38,400 tons of lead concentrates.

Germany, West.—Rammelsberg mine, Europe's oldest continuously operated lead, copper, and silver producer, celebrated its thousandth anniversary in 1968. Mining operations began in 968 under Emperor Otto I and have continued since under many ownerships. This mine along with neighboring mines on the northern edge of the Hartz Mountains belong to Sparte Metall, a subsidiary of Preussag A.G. of Hanover.

Iran.—Rio Tinto-Zinc Corp. Ltd. placed a 600-ton-per-day mill in operation late in 1968 at the Kouchke mine east of Yazd in central Iran. The project is owned by Rio Tinto, Société Minière et Métallurgique de Peñarroya and the Iranian company Simiran. Annual production

TECHNOLOGY

Technological development continued to be a major activity in the lead industry and associated research organizations. Adaptation of large-capacity equipment and mining methods to underground mining in the Missouri mines have significantly increased manpower productivity. Automation of concentrating plants and smelters has also in-

dustry in view of the substitution potential of plastic and other materials. Automated soldering techniques have expanded greatly to step up production in assembly wiring. The lubricating quality of lead as a lead phosphate coating on steel has permitted significant increases in stamping press output. Development of a sintered ferrous skeleton impregnated with 15 to 30 percent lead for electric railroad power shoe has

many potential applications in moving machine parts. Research and development of adhesives and lamination techniques for lead-plastic composites promise to combine the respective benefits of each material. Organolead chemicals have received major attention in the area of lubricants, catalysts, wood preservatives, and rot-resistant textiles.

Table 2.—Mine production of recoverable lead in the United States, by States

State	(Short tons)				
	1964	1965	1966	1967	1968
Alaska.....	6,117	(1)	14	4,771	(1)
Arizona.....	1,546	5,919	1,276	1,736	1,704
California.....	22,495	21,810	21,736	21,929	19,001
Colorado.....	71,312	66,606	72,384	61,887	54,778
Idaho.....	2,180	3,006	2,286	2,384	1,467
Illinois.....	1,185	1,644	1,109	1,031	1,227
Kansas.....	868	766	484	846	(1)
Kentucky.....	120,148	139,621	132,266	152,648	212,611
Massachusetts.....	4,638	6,981	4,409	1,898	1,870
Montana.....	1,925	2,277	3,681	1,600	1,868
Nevada.....	809	3,367	1,696	1,827	1,395
New Mexico.....	1,925	3,367	1,696	1,827	1,395
New York.....	2,782	2,701	2,959	2,727	2,387
North Carolina.....	2,781	(1)	2,959	2,727	(1)
Oklahoma.....	(1)	(1)	181	53,813	45,206
Tennessee.....	40,249	37,700	64,124	3,490	3,673
Utah.....	3,857	3,651	3,078	2,762	6,656
Virginia.....	6,731	6,328	1,694	1,596	1,126
Washington.....	1,742	1,645	14	140	140
Wisconsin.....	6	14	14	14	140
Other States.....	286,010	301,147	327,368	316,931	359,166
Total.....	286,010	301,147	327,368	316,931	359,166

1 Combined with "Other States" to avoid disclosing individual company confidential data.

Table 3.—Ore, old tailings, etc., yielding lead and zinc in the United States in 1968

State	(Short tons)								
	Lead ore			Zinc ore			Lead-zinc ore		
	Gross weight	Lead	Zinc	Gross weight	Lead	Zinc	Gross weight	Lead	Zinc
Arizona.....	498	45	(1)	194	1	14	98,566	1,635	3,443
California.....	6,112	1,629	245	12	1	1	63,297	2,229	3,274
Colorado.....	1,924	170	4	257,871	1,622	24,415	269,318	7,248	10,858
Idaho.....	160,949	13,211	1,506	44,846	1,203	3,326	666,670	33,398	44,536
Kansas.....	6,855,777	212,589	12,260	84,176	277	1,860	75,936	950	1,162
Missouri.....	5,514	970	108	14,551	169	1,302	475	22	41
Montana.....	9,191	214	82	1,151	42	234	952	74	45
Nevada.....	156,746	5	—	156,746	—	25,668	70,304	601	1,835
New Jersey.....	43	5	—	245,454	1,386	17,713	(1)	(1)	(1)
New Mexico.....	254	4	—	785,109	1,386	66,194	(1)	(1)	(1)
New York.....	—	—	—	203,684	1,606	5,556	71,537	777	1,365
Oklahoma.....	—	—	—	629,136	—	30,382	—	—	—
Pennsylvania.....	—	—	—	4,844,180	—	116,999	—	—	—
Tennessee.....	432	46	9	42	(1)	4	433,963	40,275	29,210
Utah.....	—	—	—	659,207	8,573	19,257	—	—	—
Virginia.....	—	—	—	364,837	701	9,237	197,886	4,954	4,647
Washington.....	—	—	—	923,308	1,126	25,711	—	—	—
Wisconsin.....	—	—	—	376,627	—	16,081	—	—	—
Other States.....	—	—	—	—	—	—	—	—	—
Total.....	6,540,694	228,883	14,164	9,091,129	13,273	362,954	1,948,904	92,163	100,406
Copper-lead, copper-zinc, and copper-lead-zinc ores									
All other sources 1									
Total									
Arizona.....	22,090	2	1,606	30,165,674	21	378	30,287,022	1,704	5,441
California.....	—	—	—	8,543	142	5	72,964	4,001	3,525
Colorado.....	450,697	10,374	14,872	74,919	364	109	1,054,729	19,778	50,258
Idaho.....	—	—	—	604,292	6,978	7,880	1,676,756	64,790	57,248
Kansas.....	—	—	—	—	—	—	160,112	1,227	3,012
Missouri.....	—	—	—	—	—	—	6,856,252	212,611	12,301
Montana.....	—	—	—	80,256	657	2,823	101,273	1,870	3,778
Nevada.....	—	—	—	8,589	6	3	89,235	863	2,104
New Jersey.....	—	—	—	—	—	—	156,745	—	25,668
New Mexico.....	65,299	12	743	578,895	11	280	889,691	1,363	13,686
New York.....	—	—	—	—	—	—	785,109	1,396	66,194
Oklahoma.....	—	—	—	—	—	—	275,475	2,387	6,921
Pennsylvania.....	—	—	—	—	—	—	629,136	—	30,382
Tennessee.....	1,624,400	—	8,040	—	—	—	5,968,580	—	124,039
Utah.....	122,381	4,632	8,526	8,569	202	404	565,877	45,205	35,153
Virginia.....	—	—	—	—	—	—	659,207	8,573	13,257
Washington.....	—	—	—	17	—	(1)	562,740	5,656	13,384
Wisconsin.....	—	—	—	—	—	—	923,308	1,126	25,711
Other States.....	—	—	—	611,249	1,386	11,808	887,876	1,507	27,884
Total.....	2,284,867	15,070	28,787	32,235,998	9,767	23,135	52,101,587	359,156	529,446

1 Less than 1/2 unit.

2 Lead-zinc and copper-lead, copper-zinc, and copper-lead-zinc ores combined to avoid disclosing individual company confidential data.

3 Lead and zinc recovered from copper, gold, silver, fluorspar, and from smelter slags, mill tailings, and miscellaneous cleanups.

Table 4.—Mine production of recoverable lead in the United States, by months

(Short tons)					
Month	1967	1968	Month	1967	1968
January.....	25,622	24,493	August.....	24,730	33,163
February.....	25,428	24,282	September.....	22,839	31,119
March.....	30,065	24,083	October.....	25,366	36,567
April.....	29,368	27,440	November.....	24,225	33,188
May.....	32,051	31,052	December.....	24,822	33,943
June.....	28,032	28,965			
July.....	24,383	30,861	Total.....	316,931	369,166

Table 5.—Twenty-five leading lead-producing mines in the United States in 1968, in order of output

Rank	Mine	County and State	Operator	Source of lead
1	Fletcher.....	Reynolds, Mo.....	St. Joseph Lead Co.....	Lead ore.
2	Viburnum.....	Crawford, Iron, and Washington, Mo.	do.....	Do.
3	Federal.....	St. Francois, Mo.....	do.....	Do.
4	Bunker Hill.....	Shoshone, Idaho.....	The Bunker Hill Co.....	Lead-zinc ore, silver tailings, zinc ore.
5	U.S. and Lark.....	Salt Lake, Utah.....	United States Smelting Refining and Mining Co.	Lead-zinc ore.
6	Magmont.....	Iron, Mo.....	Cominco American, Inc.....	Lead ore.
7	Idarado.....	Ouray and San Miguel, Colo.....	Idarado Mining Co.....	Copper-lead-zinc ore.
8	Indian Creek.....	Washington, Mo.....	St. Joseph Lead Co.....	Lead ore.
9	Burgin.....	Utah, Utah.....	Kennecott Copper Corp.....	Lead-zinc ore.
10	Lucky Friday.....	Shoshone, Idaho.....	Hecia Mining Co.....	Lead ore.
11	Ozark.....	Reynolds, Mo.....	Ozark Lead Co.....	Do.
12	Star-Morning.....	Shoshone, Idaho.....	Hecia Mining Co.....	Lead-zinc ore.
13	Pend Oreille.....	Pend Oreille, Wash.....	Pend Oreille Mines & Metals Co.	Do.
14	Mayflower.....	Wasatch, Utah.....	Hecia Mining Co.....	Copper-lead-zinc ore.
15	United Park City.....	Summit, Utah.....	United Park City Mines Co.	Lead-zinc ore.
16	Page.....	Shoshone, Idaho.....	American Smelting and Refining Company.	Do.
17	Austinville and Ivanhoe.....	Wythe, Va.....	The New Jersey Zinc Co.....	Do.
18	Ophir.....	Tooele, Utah.....	United States Smelting Refining and Mining Co.	Do.
19	Darwin.....	Inyo, Calif.....	West Hill Exploration Co.....	Do.
20	Dayrock.....	Shoshone, Idaho.....	Day Mines, Inc.....	Lead ore.
21	Iron King.....	Yavapai, Ariz.....	McFarland and Hullinger.....	Lead-zinc ore.
22	Eagle.....	Eagle, Colo.....	The New Jersey Zinc Co.....	Zinc, silver ores.
23	Brenneman.....	San Juan, Colo.....	Standard Metals Corp.....	Lead-zinc ore.
24	Sunnyside.....	do.....	do.....	Do.
25	Emperius.....	Mineral, Colo.....	Emperius Mining Co.....	Do.

Table 6.—Refined lead produced at primary refineries in the United States, by source material

(Short tons)					
	1964	1965	1966	1967	1968
Refined lead:					
From primary sources:					
Domestic ores and base bullion.....	294,254	305,007	318,646	258,507	349,039
Foreign ores and base bullion.....	156,175	113,242	122,089	121,387	118,271
Total.....	449,429	418,249	440,735	379,894	467,310
From secondary sources.....	8,605	13,140	9,004	2,588	2,269
Grand total.....	457,934	431,389	449,739	382,432	469,569
Calculated value of primary refined lead (thousands).....	\$122,424	\$138,840	\$133,278	\$106,370	\$123,463

* Value based on average quoted price, New York, and excludes value of refined lead produced from scrap primary refineries.

LEAD

Table 7.—Antimonial lead produced at primary lead refineries

Year	Production (short tons)	Antimony content	
		Short tons	Per cent
1964.....	24,023	1,995	8.3
1965.....	27,895	1,984	7.1
1966.....	24,069	2,119	8.8
1967.....	18,608	1,717	9.2
1968.....	26,863	2,007	7.1

Table 8.—Stocks and consumption of new and old lead

(Short tons, gross weight)			
Class of consumers and type of scrap	Stocks Jan. 1	Receipts	Consumption
Smelters and refiners:			
Soft lead.....	2,600	51	
Hard lead.....	1,446	14	
Cable lead.....	943	31	
Battery-lead plates.....	28,785	461	
Mixed common babbitt.....	835	4	
Solder and tinny lead.....	279	11	
Type metals.....	3,603	84	
Drosses and residues.....	19,767	107	
Total.....	57,704	717	
Foundries and other manufacturers:			
Soft lead.....	16		
Hard lead.....	24		
Cable lead.....	18		
Battery-lead plates.....	47		
Mixed common babbitt.....	82	7	
Solder and tinny lead.....			
Type metals.....			
Drosses and residues.....	84		
Total.....	271	7	
All consumers:			
Soft lead.....	2,616	51	
Hard lead.....	1,470	14	
Cable lead.....	961	31	
Battery-lead plates.....	28,782	461	
Mixed common babbitt.....	417	11	
Solder and tinny lead.....	279	11	
Type metals.....	3,603	34	
Drosses and residues.....	19,851	107	
Grand total.....	57,979	726	

* Revised.

Table 9.—Secondary metal recovered¹ from lead and tin scrap in the United States in 1968, by type of products

(Short tons, gross weight)

	Lead	Tin	Antimony	Other	Total
Refined pig lead.....	118,015	-----	-----	-----	118,015
Remelt lead.....	20,861	-----	-----	-----	20,861
Total.....	138,876	-----	-----	-----	138,876
Refined pig tin.....	-----	3,153	-----	-----	3,153
Remelt tin.....	-----	182	-----	-----	182
Total.....	-----	3,335	-----	-----	3,335
Lead and tin alloys:					
Antimonial lead.....	308,563	448	17,365	329	326,705
Common babbitt.....	12,196	709	1,452	60	14,417
Genuine babbitt.....	35	229	25	10	299
Solder.....	29,637	4,721	503	90	34,951
Type metals.....	27,334	1,797	4,163	18	33,312
Cable lead.....	17,884	-----	174	5	18,063
Miscellaneous alloys.....	1,222	849	17	109	1,697
Total.....	396,871	8,253	23,699	621	429,444
Tin content of chemical products.....	-----	587	-----	-----	587
Grand total.....	635,737	12,175	23,699	621	672,232

¹ Most of the figures herein represent actual reported recovery of metal from scrap.

Table 10.—Secondary lead recovered in the United States

(Short tons)

	1964	1965	1966	1967	1968
As metal:					
At primary plants.....	8,505	13,140	9,004	2,538	2,259
At other plants.....	140,702	168,774	147,215	147,806	136,607
Total.....	149,207	181,914	156,219	150,344	138,866
In antimonial lead:					
At primary plants.....	13,421	19,299	10,758	7,808	6,862
At other plants.....	257,101	251,354	272,977	280,911	301,701
Total.....	270,522	270,653	283,735	288,719	308,563
In other alloys.....	121,853	123,252	132,880	114,709	108,450
Grand total:					
Quantity.....	541,582	575,819	572,834	553,772	550,379
Value (thousands) ¹	\$147,627	\$184,262	\$173,225	\$155,056	\$146,542

¹ Value based on average quoted price, New York.

Table 11.—Lead recovered from scrap by kind of scrap and form

(Short tons)

Kind of scrap	1967	1968	
New scrap:			As so
Lead-base.....	71,829	73,845	A
Copper-base.....	4,500	5,219	A
Tin-base.....	678	548	
Total.....	76,907	79,612	
Old scrap:			In an
Battery-lead plates.....	303,253	310,215	In ot
All other lead-base.....	156,892	142,968	In co
Copper-base.....	17,711	18,085	In th
Tin-base.....	4	4	
Total.....	478,655	471,267	
Grand total.....	555,562	550,879	

¹ Includes 7,808 tons of lead recovered in antimonial lead and 6,862 tons in 1968.

Table 12.—Lead consumption in the

(Short tons)

Product	1967	1968	
Metal products:			
Ammunition.....	78,765	82,193	Pigmen
Bearing metals.....	19,561	19,441	Pi
Brass and bronze.....	20,467	21,021	On
Cable covering.....	63,037	58,456	
Calking lead.....	48,789	49,718	
Castings metals.....	10,083	8,693	
Collapsible tubes.....	11,299	9,310	Chem
Foil.....	6,148	6,114	G
Pipes, traps, and bends.....	20,184	21,098	
Sheet lead.....	26,763	28,271	M
Solder.....	68,883	74,074	
Storage batteries:			
Battery grids, posts, etc.....	229,287	250,129	Miscel
Battery oxides.....	237,378	263,574	A
Terne metal.....	1,620	1,427	G
Type metal.....	28,554	27,981	L
Total.....	870,769	915,500	W
Pigments:			Other,
White lead.....	8,087	5,857	
Red lead and litharge.....	76,589	86,480	

¹ Includes lead content of leaded zinc oxide and other pig² Includes lead which went directly from scrap to fabricat

Table 13.—Lead consumption in the

(Short tons)

Month	1967	1968	
January.....	107,431	110,608	August
February.....	99,789	106,261	Septer
March.....	112,912	106,621	Octob
April.....	106,964	108,113	Novem
May.....	110,808	112,189	Decem
June.....	106,011	104,479	
July.....	84,161	98,801	

¹ Includes lead content of leaded zinc oxide and other pig fabricated products.

Table 14.—Lead consumption in the United States in 1968, by class of products and types of material

(Short tons)					
Product	Soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
Metal products.....	194,833	104,773	48,974	15,670	364,250
Storage batteries.....	270,205	243,498	-----	-----	513,703
Pigments.....	107,258	-----	-----	-----	107,258
Chemicals.....	262,354	172	-----	-----	262,526
Miscellaneous.....	10,252	12,814	40	-----	23,106
Unclassified.....	15,381	2,079	464	-----	17,924
Total.....	860,283	363,336	49,478	15,670	1,288,767

¹ Excludes 37,547 tons of lead which went directly from scrap to fabricated products and 2,476 tons of lead contained in leaded zinc oxide and other nonspecified pigments.

Table 15.—Lead consumption in the United States in 1968, by States¹

(Short tons)					
State	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
California.....	89,212	81,622	6,241	709	127,784
Colorado.....	1,114	2,600	95	-----	3,709
Connecticut.....	17,171	16,442	112	1,620	36,245
District of Columbia.....	160	-----	-----	-----	160
Florida.....	6,249	6,288	-----	-----	11,532
Georgia.....	89,720	16,199	2,617	-----	58,436
Illinois.....	80,816	50,272	9,846	2,093	148,027
Indiana.....	76,831	42,411	1,685	814	121,641
Kansas.....	11,046	9,151	88	377	20,612
Kentucky.....	2,795	7,115	1	-----	9,911
Maryland.....	4,374	17,414	166	-----	21,954
Massachusetts.....	4,147	866	193	47	5,253
Michigan.....	18,158	20,879	1,881	433	41,351
Missouri.....	38,042	14,684	164	420	53,310
Nebraska.....	2,805	1,016	26	778	4,625
New Jersey.....	127,942	21,498	9,055	489	158,984
New York.....	40,120	2,280	9,552	780	52,732
Ohio.....	13,988	3,928	3,432	836	22,184
Pennsylvania.....	51,449	31,448	1,120	3,044	87,061
Rhode Island.....	1,276	450	35	-----	1,761
Tennessee.....	170	11,387	328	252	12,087
Virginia.....	1,211	1,193	738	1,387	4,479
Washington.....	6,663	478	314	-----	7,455
West Virginia.....	18,963	3,043	-----	-----	22,006
Wisconsin.....	3,065	2,807	42	148	6,062
Alabama and Mississippi.....	1,003	2,865	-----	623	4,491
Arkansas and Oklahoma.....	3,631	3,886	99	-----	7,116
Hawaii and Oregon.....	940	2,672	-----	-----	3,612
Iowa and Minnesota.....	3,131	8,616	127	490	12,363
Louisiana and Texas.....	182,253	21,139	1,726	312	206,424
Montana and Idaho.....	4,691	-----	-----	-----	4,691
New Hampshire, Maine, Vermont, Delaware.....	5,067	7,711	46	168	12,991
North and South Carolina.....	2,001	2,638	-----	-----	4,639
Utah, Nevada, Arizona.....	89	-----	-----	-----	89
Total.....	860,283	363,336	49,478	15,670	1,288,767

¹ Excludes 37,547 tons of lead which went directly from scrap to fabricated products and 2,476 tons of lead contained in leaded zinc oxide and other non-specified pigments.

Table 16.—Production and shipments of leaded pigments

Pigment	1967		
	Production (short tons)	Shipments	
		Short tons	Value ¹
White lead:			
Dry.....	7,316	8,871	\$3,609,808
In oil.....	2,807	3,257	2,205,973
Total.....	10,123	12,128	5,815,781
Red lead.....	26,869	26,741	8,814,995
Litharge.....	95,581	99,982	32,135,289
Black oxide.....	208,671	-----	-----

¹ Except for basic lead sulfate, figures withheld to avoid disclosure.

² At plant, exclusive of container.

³ Weight of white lead only, but value of paste.

Table 17.—Lead content of lead and zinc produced by domestic manufacturers

(Short tons)				
Pigment	1967			Total lead pigment
	Lead in pigments produced from—		Pig lead	
	Ore			
	Do- mestic	For- eign		
White lead.....	-----	-----	8,098	8,098
Red lead.....	-----	-----	24,357	24,357
Litharge.....	-----	-----	88,890	88,890
Black oxide.....	-----	-----	194,909	194,909
Leaded zinc oxide.....	798	512	-----	1,310
Total....	798	512	316,254	317,562

¹ Excludes lead in basic lead sulfate, figures withheld to avoid disclosure.

Table 18.—Distribution of white lead (dry and paste)

(Short tons)		
Industry	1964	1965
Paints.....	10,634	9,111
Ceramics.....	143	143
Other.....	4,769	5,888
Total.....	15,446	14,642

¹ Excludes basic lead sulfate, figures withheld to avoid disclosure.

Table 19.—Distribution of red lead shipments, by industries

(Short tons)					
Industry	1964	1965	1966	1967	1968
Paints.....	14,133	13,725	14,480	18,318	11,347
Other.....	13,957	16,938	16,790	12,423	12,464
Total.....	28,090	29,663	31,270	25,741	23,811

Table 20.—Distribution of litharge shipments, by industries

(Short tons)					
Industry	1964	1965	1966	1967	1968
Ceramics.....	20,608	21,018	23,476	19,491	24,123
Chrome pigments.....	6,426	W	W	W	W
Insecticides.....	W	1,161	1,166	W	W
Oil refining.....	2,142	2,886	1,991	1,835	1,849
Rubber.....	1,978	2,153	2,296	1,928	1,986
Varnish.....	4,004	3,763	1,620	1,223	W
Other.....	64,886	74,916	79,764	76,500	103,220
Total.....	99,393	105,892	110,303	99,982	131,178

W Withheld to avoid disclosing individual company confidential data; included with "Other."

Table 21.—U.S. imports for consumption of lead pigments and compounds

Kind	1967		1968	
	Short tons	Value (thousands)	Short tons	Value (thousands)
White lead.....	2,293	\$672	2,158	\$672
Red lead.....	3,296	761	4,412	977
Litharge.....	24,632	4,969	24,829	5,131
Other lead pigments.....	76	22	207	54
Other lead compounds.....	372	152	398	116
Total.....	30,669	6,576	32,004	6,950

* Revised.

Table 22.—Stocks of lead at primary smelters and refineries in the United States, December 31

(Short tons)					
Stocks	1964	1965	1966	1967	1968
Refined pig lead.....	34,100	17,524	16,175	18,243	11,490
Lead in antimonial lead.....	4,012	7,680	6,396	6,119	3,852
Lead in base bullion.....	13,218	10,735	15,606	16,622	11,471
Lead in ore and matte.....	33,068	47,604	77,296	85,496	63,614
Total.....	84,398	83,443	115,473	125,479	90,427

Table 23.—Consumer stocks of lead in the United States

(Short tons, lead content)		
Year	Refined soft lead	Lead in antimonial lead
1964.....	69,361	35,163
1965.....	61,586	38,190
1966.....	44,490	34,704
1967.....	59,837	36,879
1968.....	48,938	36,009

Table 24.—Average monthly and yearly prices of lead at St. Louis, New York, and London

Month	1967	
	St. Louis	New York
January.....	13.80	14.00
February.....	13.80	14.00
March.....	13.80	14.00
April.....	13.80	14.00
May.....	13.80	14.00
June.....	13.80	14.00
July.....	13.80	14.00
August.....	13.80	14.00
September.....	13.80	14.00
October.....	13.80	14.00
November.....	13.80	14.00
December.....	13.80	14.00
Average.....	13.80	14.00

¹ St. Louis: Metal Statistics, 1969. New York: Metal Statistics, 1969.

² Based on monthly rates of exchange by Federal Reserve Bank of New York.

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Table 25.—U.S. exports of lead, by countries¹

Destination	1966		1967		1968	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
PIGS, BARS AND ANODES						
Belgium-Luxembourg	1,115	\$913	13	\$22	769	\$799
Brazil	789	260	558	163	504	165
Canada	299	309	353	360	450	372
Chile	56	27	587	205	1,404	521
Colombia	580	237	237	71	37	20
Italy	12	28	42	51	664	266
Japan	15	18	1,402	491	1,145	285
Mexico	156	98	200	550	141	90
Netherlands	118	364	155	405	412	343
Philippines	68	41	119	89	287	119
Spain	11	8	1	3	69	36
Sweden	151	120	263	472	187	137
Taiwan	233	88	190	50	31	18
United Kingdom	200	348	321	471	191	234
Venezuela	346	214	206	208	634	222
Vietnam, South	521	227	19	6	99	34
Other	805	682	1,869	1,140	1,267	1,028
Total	5,435	3,967	6,536	4,767	8,281	4,740
SCRAP						
Belgium-Luxembourg	101	20	35	15	207	50
Canada			56	34	116	24
Germany, West					113	17
Japan			16	10		
Netherlands	288	68	139	55	124	28
United Kingdom	138	60	120	76	367	95
Other	21	17	28	8	10	5
Total	498	165	394	198	937	219
Grand total	5,933	4,132	6,930	4,965	9,218	4,959

¹ In addition foreign lead was reexported as follows: pigs, bars and anodes; 1966: 7 tons (\$3,806), 1967: 162 tons (\$33,794); 1968: 11 tons (\$19,211). Scrap; 1966-68, none.

LEAD

Table 26.—U.S. imports¹ of

Country	1968	
	Short tons	Value (thousands)
Ore, fine dust, and matte (lead content):		
Australia	22,614	
Bolivia	11,186	
Canada	52,707	
Chile	7	
Colombia	445	
Guatemala	85	
Honduras	11,182	
Mexico	624	
Peru	41,610	
Philippines	164	
South Africa, Republic of	1,394	
Other	2,123	
Total	143,991	
Base bullion (lead content):		
Australia	1,283	
Belgium-Luxembourg		
Canada	62	
France		
Germany, West	56	
Mexico	547	
Peru	64	
United Kingdom		
Total	2,012	
Pigs and bars (lead content):		
Australia	44,187	
Belgium-Luxembourg	2,585	
Burma	5,532	
Canada	34,283	
Denmark	672	
Germany, West	15,499	
Mexico	75,294	
Peru	51,593	
South Africa, Republic of	11,986	
Sweden		
United Kingdom	8,101	
Yugoslavia	31,322	
Zambia	1,148	
Other	8,237	
Total	285,389	
Reclaimed scrap, etc. (lead content):		
Australia	3,843	
Canada	2,857	
Dominican Republic	179	
Germany, West		
Mexico	314	
Netherlands Antilles	188	
New Zealand	50	
Panama	80	
Other	185	
Total	7,696	
Grand total	489,088	

¹ Revised.

² Data are "general imports"; that is they include lead imported into the country under bond.

³ Less than $\frac{1}{2}$ unit.

Table 27.—U.S. imports for consumption¹ of lead, by countries

Country	1966		1967		1968	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
Lead ore, flue dust, and matte (lead content):						
Australia.....	21,460	\$4,636	37,879	\$7,160	12,640	\$2,274
Bolivia.....	1,454	376	14,707	3,020	6,708	1,308
Canada.....	28,617	5,099	41,416	8,956	31,458	6,463
Chile.....	228	84	892	172	2,440	513
Colombia.....	84	17	172	113	113	17
Honduras.....	8,506	785	5,850	1,085	7,780	1,532
Ireland.....	426	72	409	50	6,469	1,130
Mexico.....	10,177	2,053	40,321	8,218	28,999	5,545
Peru.....	426	72	409	50	321	54
Philippines.....	2,968	811	264	78	1	1
South Africa, Republic of.....	2,968	811	478	61	836	183
Sweden.....	20	5	2,877	816	16	30
Other.....	20	5	63	16	163	30
Total.....	68,850	13,871	144,156	29,111	96,863	18,990
Lead bullion (lead content):						
Australia.....	1,272	323	442	118	14	78
Belgium-Luxembourg.....	62	27	23	96	14	78
Canada.....	56	14	20	178	13	126
Germany, West.....	474	109	66	809	86	440
Mexico.....	64	102	71	16	12	63
Peru.....	64	102	71	16	12	63
United Kingdom.....	64	102	71	16	12	63
Other.....	64	102	71	16	12	63
Total.....	1,928	575	677	1,224	63	643
Pigs and bars (lead content):						
Australia.....	44,160	10,859	53,156	11,900	46,919	9,851
Belgium-Luxembourg.....	2,535	606	28,281	5,074	19,149	4,354
Burma.....	5,532	1,375	2,548	590	60,161	14,637
Canada.....	34,283	9,858	87,236	9,728	60,161	14,637
Denmark.....	672	184	423	226	46	41
Germany, West.....	15,499	6,002	49,077	12,726	19,711	7,833
Japan.....	2,106	522	75,894	16,665	57,271	13,019
Mexico.....	75,894	16,665	57,271	13,019	56,518	12,062
Morocco.....	5,137	1,518	2,413	485	205	66
Netherlands.....	61,598	14,824	70,377	18,506	75,105	18,896
Peru.....	11,925	3,824	6,989	1,937	8,298	2,201
South Africa, Republic of.....	3,101	977	17,680	4,344	22,919	5,546
United Kingdom.....	31,322	8,190	30,478	6,941	19,775	4,156
Yugoslavia.....	2,529	908	11,789	2,908	8,816	2,123
Other.....	2,529	908	11,789	2,908	8,816	2,123
Total.....	285,788	75,312	363,596	88,697	337,620	81,264
Reclaimed scrap, etc. (lead content):						
Australia.....	61	11	67	11	80	14
Canada.....	2,807	681	6,940	1,296	2,834	523
Dominican Republic.....	179	28	243	42	292	31
Germany, West.....	179	28	1,568	369	6	111
Japan.....	814	40	278	48	670	111
Mexico.....	188	33	167	35	60	11
Netherlands Antilles.....	50	8	80	12	64	11
New Zealand.....	80	12	374	56	221	27
Peru.....	150	46	27	81	78	15
Other.....	127	27	283	81	78	15
Total.....	3,966	886	9,858	1,951	4,249	748
Lead pipe and shot:						
Belgium-Luxembourg.....	219	64	513	129	344	90
Canada.....	80	13	99	88	182	65
Germany, West.....	134	45	2	(¹)	12	4
Netherlands.....	514	154	402	105	249	64
United Kingdom.....	22	7	76	22	112	32
Other.....	22	7	120	28	112	32
Total.....	919	283	1,212	822	893	256
Grand total.....	856,441	90,927	519,009	121,805	439,688	101,901

¹ Excludes imports for consumption in bond and export, classified as "imports for consumption" by the Bureau of the Census.
² Less than 1/2 unit.

Table 28.—U.S. imports for consumption

(Thousand short tons and thousand dollars)

Year	Lead in ore, flue dust, and matte, n.s.p.f. (lead content)		Lead in base bullion (lead content)		Pigs and bars (lead content)	
	Quantity	Value	Quantity	Value	Quantity	Value
1966.....	64	\$18,871	2	\$575	285	\$75,312
1967.....	144	29,111	1	1,224	364	88,697
1968.....	97	18,990	(¹)	643	388	81,264

¹ Excludes imports for consumption in bond and export, classified as "imports for consumption" by the Bureau of the Census.
² Less than 1/2 unit.

Table 29.—U.S. imports for consumption of miscellaneous

Year	Babbitt	
	Quantity (short tons)	Value (thousand dollars)
1966.....	1,585	778
1967.....	1,778	778
1968.....	1,204	778

PRICES

The average value of crude vermiculite, mined at the mine, was \$19.60 per short ton. The exfoliated product average value, at producers plant, was \$79.08 per short ton. For the past 5 years, 1964-68, the price of crude vermiculite increased 23 percent, while the price of exfoliated vermiculite rose less than 1 per-

cent. The market prices quoted by Engineering and Mining Journal for crude vermiculite from Montana and South Carolina ranged from \$18 to \$35 per ton, f.o.b. mine. Material from the Republic of South Africa ranged from \$29.55 to \$40.15 per ton, c.i.f. Atlantic ports.

FOREIGN TRADE

Imports of crude vermiculite from the Republic of South Africa in 1967 were 9 percent higher than in 1966. Crude

vermiculite was imported duty free to the United States.

WORLD REVIEW

South Africa, Republic of.—Production of crude vermiculite was 9 percent higher in 1967. Total exports increased 9 percent over the 1967 tonnage, and value

increased 16 percent. The average unit value of crude vermiculite exported from South Africa increased \$1.12 per ton.

Table 2.—Free world production of vermiculite by countries

(Short tons)					
Country	1964	1965	1966	1967	1968 ^a
Argentina	4,071	1,867	4,588	2,641	NA
Australia	NA	NA	441	240	2,724
Canada	473	807	551	349	2,688
France	37	24	84	277	308
Germany, West	111,872	126,911	118,732	111,885	121,427
Italy	144	108	177	100	38
Japan	459	689	NA	NA	NA
United Arab Republic	226,299	249,352	262,321	254,997	289,997
United States (sold or used by producers)					
Total	843,355	879,698	881,894	870,489	417,077

Revised. ^a Preliminary. NA Not available.
Includes mica.
Total is of listed figures only.

Table 3.—Republic of South Africa: Exports of crude vermiculite by countries

(Short tons)			
Destination	1966	1967	1968
Australia	2,649	2,833	
Canada	2,665	3,884	
France	8,523	9,418	
Germany, West	11,619	9,296	
Italy	14,123	19,088	
Japan	2,965	4,995	
Netherlands	1,216	1,744	NA
Spain	2,460	2,942	
Sweden	965	1,340	
United Kingdom	27,277	80,214	
United States	8,432	15,963	
Other countries	8,207	8,903	
Total	85,891	105,620	115,545
Total value	\$1,576,986	\$1,980,055	\$2,295,439
Average value	\$18.86	\$18.75	\$19.87

^a Revised. NA Not available.
^b Converted to U.S. currency at the rate of 1 rand equals \$1.8918 (1966), \$1.898 (1967), and \$1.40 (1968).

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Zinc

By Donald E. Moulds¹

The free world during 1968 achieved a record production and consumption of zinc. A 2-percent gain in mine production to 4.37 million tons provided the feed materials for a major 11-percent gain in metal production to 3.91 million tons. The free world supply of metal, augmented by a 39,000-ton producer stock drawdown, a 38,000-ton reduction in U.S. Government stocks, and a 72,000-ton net import from communist areas, adequately provided for the 7.6-percent increase in metal consumption and the price of zinc remained stable in all of the free world markets.

The domestic zinc industry experienced

a substantial increase in consumption percent over that achieved partially curtailed for the smelter production several plants the continuing percent and the 1966 high output, augmented increase in metal

¹ Physical scientist

Table 1.—Salient zinc statistics

	1964	1965	1968
United States:			
Production:			
Domestic ores, recoverable content, short tons	574,858	611,153	572,166
Value, thousands	\$166,308	\$178,284	\$166,308
Slab zinc:			
From domestic ores, short tons	531,967	551,215	528,129
From foreign ores, short tons	422,117	443,187	501,883
From scrap, do	71,596	83,619	83,619
Total, do	1,025,680	1,078,021	1,108,631
Secondary zinc, do	227,713	271,694	277,166
Exports of slab zinc, do	26,515	5,939	1,108
Imports (general):			
Ores (zinc content), do	357,145	428,040	521,278
Slab zinc, do	118,940	126,990	126,990
Stocks, December 31:			
At producer plants, do	31,178	28,622	64,129
At consumer plants, do	108,411	150,763	129,129
Consumption:			
Slab zinc, do	1,207,268	1,354,092	1,410,129
All classes, do	1,585,751	1,742,067	1,806,129
Price, Prime Western, East St. Louis, cents per pound	13.67	14.60	14.60
World:			
Production:			
Mine, short tons	4,440,309	4,760,887	4,960,129
Smelter, do	4,070,982	4,362,571	4,498,129
Price: Prime Western, London cents per pound	14.74	14.12	12.12

¹ Excludes redistilled slab zinc.

Secondary Zinc Smelters.—Zinc recovered from reprocessing new and old scrap amounted to 354,700 tons compared to 319,800 tons in 1967. New scrap, principally zinc-base and copper-base alloys from manufacturers and drosses from molten galvanizing and die casting pots, contributed 274,900 tons. Old scrap, consisting of die castings, engravers' plate and other obsolete or wornout objects, amounted to 79,800 tons. The zinc was recovered in alloys, 53 percent, principally brass and bronze; in metal, 34 percent; and in chemical products, 13 percent.

Byproduct Sulfuric Acid.—Gases produced in roasting zinc sulfide concentrates preparatory to retorting or electrolytic

reduction to zinc metal contain significant quantities of sulfur dioxide which are collected and processed to sulfuric acid. At several plants elemental sulfur is also burned to supplement output. Production of acid in 1968 was 990,000 tons compared with 900,200 tons in 1967.

Zinc Dust.—Production of zinc dust resumed the upward trend of recent years. In 1958 production amounted to 26,500 tons valued at \$7.3 million in comparison to the 1968 output of 61,600 tons valued at \$22 million. The statistics include only commercial grades ranging in zinc content from 95.0 to 99.6 percent and averaged 98.53 percent during the year.

CONSUMPTION AND USES

Consumption of slab zinc amounted to 1.33 million tons, 8 percent above the 1967 total but lower than that used in 1965-66. The increase in requirements occurred in essentially all of the industrial uses with the exception of a few categories in galvanizing.

Zinc-base alloy requirements represented 42 percent of the total slab in comparison to 43 percent in 1967 and the record 47 percent in 1965. Galvanizing requirements were 36 percent compared with the previous year's 37 percent. Noteworthy was the continued uptrend in galvanizing of structural shapes indicating the installation and use of large hot-dip galvanizing pots capable of galvanizing assembled structural components. Consumption in brass products was 12 percent, despite the strike at several brass mills in the first quarter, compared with the 11 percent required in 1967, a year also beset by labor strikes. Rolled zinc requirements for slab zinc advanced 8 percent to 48,900 tons although well below the 52,600 tons used in 1966. Use in zinc oxide has steadily climbed from 13,300 tons in 1958 to the 34,900 tons used in 1968.

Consumption of slab zinc by grades was as follows: Special High grade, 51 percent; Prime Western, 28 percent; Brass Special, 10 percent; Intermediate, 9 percent; and High grade and remelt, 2 percent. Galvanizing used mainly Prime Western although higher purity was required in the high-speed, continuous lines. Special High grade is required in high-speed die casting alloys

with lower grades used in sand and slush casting alloys. Zinc used as an additive in copper-base alloys ranges through the various grades although Brass Special and Intermediate are relative minor commercial grades.

Rolling mills used 48,900 tons of slab zinc and produced 47,500 tons of salable products, mainly as strip and foil. Imports of rolled products approximated 800 tons in comparison to exports of 3,000 tons and the apparent domestic consumption of 45,300 tons was 10 percent higher than in 1967. In addition, rolling mills remelted and rerolled 21,900 tons of scrap originating in manufacturing of end products at the plants.

Illinois was the leading State in total slab zinc consumption while Ohio led in galvanizing, Michigan in diecasting, and Connecticut in use in brass. Five States—Illinois, Michigan, Indiana, Pennsylvania, and New York—each consumed over 100,000 tons of slab zinc and combined accounted for almost 57 percent of the domestic total.

ZINC PIGMENTS AND COMPOUNDS

Production.—Output of zinc pigments and compounds, excluding lithopone, increased 13 percent to 336,100 tons, well above the recent high of 325,200 tons achieved in 1966. Shipments of zinc oxide and zinc sulfide exceeded production, and totaled 339,000 tons in 1968 compared with 291,800 tons in 1967 and 313,400 tons in 1966.

ZINC

Zinc oxide was processed from domestic and foreign ores, slab zinc, secondary materials, and residues. Lead-free zinc oxide produced from ores and residues by the American Process contributed 63 percent of the total. The French Process using slab zinc accounted for 25 percent and 12 percent was derived by various other oxidation processes using residues and secondary materials. Production of zinc oxide and zinc sulfate required an equivalent of 108,400 tons of zinc in ore of

which domestic cent. The 66, directly in the percent of the able zinc in ore

Lithopone, and barium white pigment and rubber, will be published company con-

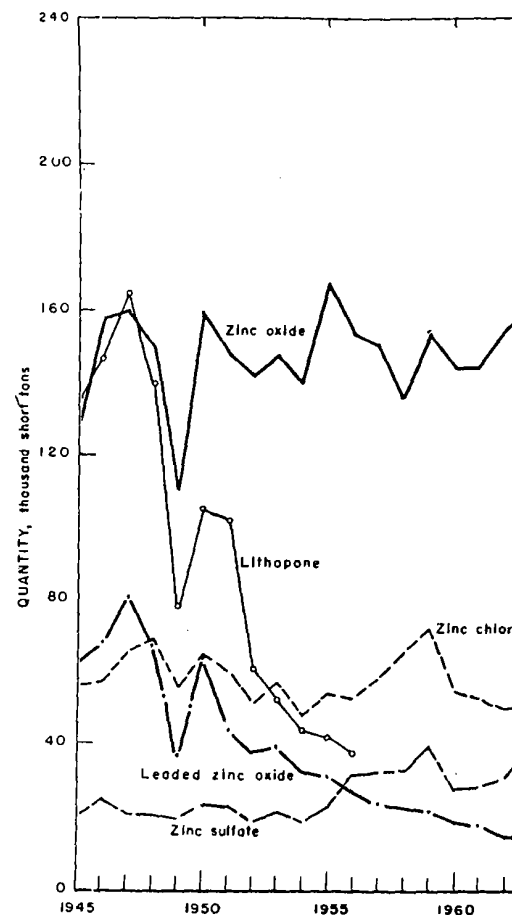


Figure 2.—Trends in shipments of zinc pigments and compounds

Consumption and Uses.—The leading use of zinc oxide was in rubber which required 52 percent of tonnage shipped. Consumption in rubber has increased significantly in the last decade, from 68,200 tons in 1958 to 111,800 tons in 1968. A small increase in paints reversed the downward trend in this area and ceramics was, also, slightly higher. Use in chemicals has doubled since 1965 and photocopying since 1966. Agriculture is rapidly becoming a major consumer of oxide as a plant and animal feed supplement.

Leaded zinc oxide continued to decrease significantly as a paint pigment although increasing slightly in other areas, especially in the low lead grades. Manufacture of zinc chloride and allied chloride compounds consumed 14,100 tons of zinc for industrial use in batteries, solder flux, fungicides, and vulcanizing. The chief uses for 54,100 tons, dry weight, of zinc sulfate shipments, a record amount, were in rayon and in agriculture.

Prices.—The stability of the zinc price at 13.5 cents per pound throughout the year was reflected in the unchanged price of zinc pigments and compounds during the year. Lead-free zinc oxide prices in carload lots, freight allowed, in cents per pound, were as follows: 15.25 for American Process, 17.50 for French Process,

Green Seal grade, 17.75 for French Process, White Seal grade. Leaded zinc oxide was quoted at 15.75 for the 35-percent grade and 16.50 for the 50-percent grade.

Zinc sulfate (monohydrate, 36 percent) in carload lots, was quoted at 9.50 cents per pound throughout the year. Zinc chloride 50° Baumé, in tank cars, was quoted at 5.80 cents per pound until October 1 when increased to 6.20 cents.

Foreign Trade.—Exports of zinc oxide were distributed among 40 countries with Belgium-Luxembourg, Canada, and Colombia the three largest recipients. Lithopone was shipped to 25 countries with Canada the major importer, followed by South Vietnam.

Imports of zinc pigments and compounds increased almost 10 percent in tonnage and 22 percent in value. Zinc oxide imports of 15,600 tons represented almost 6 percent of the new supply as indicated by domestic shipments plus imports. Mexico was the largest supplier of zinc oxide followed by the Netherlands, United Kingdom, West Germany, and Canada. The leading supplier of zinc sulfide was West Germany who also supplied most of the lithopone. Zinc chloride was largely supplied by Belgium-Luxembourg and West Germany and Mexico was the predominant source of zinc sulfate.

STOCKS

Producer Stocks.—Stocks of slab zinc at producer plants amounted to 81,900 tons at the beginning of the year and after a drawdown during the first quarter to about 63,000 tons at the end of March gradually built up to 85,000 tons at the end of August and then declined to 63,100 tons at yearend. Producer stocks, other than at plants, as reported by the Zinc Institute, ranged from a low of 7,200 tons in April to 15,500 tons at yearend.

Consumer Stocks.—Slab zinc stocks held by consumers opened the year at 102,500 tons but were reduced to about 74,000 tons at the end of November. A drop in consumption, increased metal imports, and continued high-level domestic production and shipment in December, however, increased stocks to 102,400 tons, only 100 tons below that existing at the start of the year.

PRICES

The price of slab zinc in world markets was steady throughout the year after a downward adjustment in 1967. The quoted price of Prime Western grade, East St. Louis market, after a decrease from 14.5 cents per pound to 13.5 cents, effective June 19, 1967, continued unchanged throughout 1968. The European producer

price was also steady at 12.25 cents (U.S. equivalent). The London Metal Exchange (LME) monthly average range was narrow with a low of 11.7 cents in March and April and a high of 12.2 cents in August. The closing LME settlement price on December 29, 1968, was 12.01 cents per pound.

FOREIGN TRADE

Exports of slab zinc increased to 33,000 tons of which India received 98 percent, again reflecting deliveries of Government stockpile zinc in connection with contracts through the U.S. Agency for International Development. Export of rolled zinc items—sheets, plates, strip, etc.—continued to decline with shipment of 3,000 tons of which Canada imported 65 percent. Export of scrap and dross increased to 2,300 tons zinc content, and a major increase to a total of 15,000 tons in export of miscellaneous semifabricated zinc items was reported by the Bureau of the Census.

General imports amounted to 546,400 tons of zinc in ores and 306,500 tons of metal. The import of ore was believed to be a record high surpassing the 539,000 tons received in 1943. The 306,500 tons of zinc metal imported was also a record surpassing the 269,000 tons received in 1957 just prior to imposition of import

WORLD REVIEW

Statistical summaries of world zinc production and consumption compiled by the Bureau of Mines, American Bureau of Metal Statistics (ABMS), and the International Lead and Zinc Study Group, vary in reporting base, sources, and scope of estimating. Free world mine production thus ranges from the 4.17 million ton total of ABMS through the 4.37 million ton total of the Bureau of Mines to the 4.39 million tons of the Lead and Zinc Study Group. The addition of the Bureau of Mines estimate of 1.1 million tons mined in communist areas, excluding Yugoslavia, results in a world total of 5.47 million tons, an increase of almost 2 percent over the 1967 total. Smelter output also varies widely with the Bureau of Mines reporting insofar as possible, primary metal while the Lead and Zinc Study Group reports slab zinc output from both primary and secondary sources. Free world smelter output of zinc thus ranges from 3.91 million tons reported by the Bureau of Mines through 3.96 million tons reported by ABMS to the 4.03-million-ton total of the Lead and Zinc Study Group. In addition, the communist areas, excluding Yugoslavia, are estimated to have produced 1.1 million tons, thus giving a world smelter output of some 5 million tons in 1968, an 11-percent