BAUXITE AND ALUMINUM

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SUMMARY OUTLINE

Production of aluminum in the United States in 1939 shattered all previous records, and consumption equaled the peak reached in 1937. Exports and total sales of metal by the Aluminum Co. of America were the largest in history. These achievements were abnormal in that the demand for aluminum was enhanced by preparations for national defense and the wars abroad. The aviation industry consumed twice the quantity of aluminum it did in 1937, the previous peak. Another noteworthy year for the metal is predicted for 1940 as war demands continue and uses for aluminum products widen. Domestic aluminum production in 1939 was 14 percent above that for 1938 and exceeded the previous high attained in 1937 by 12 percent. Primary producers withdrew 56 percent of the metal added to stocks in 1938, and apparent domestic consumption increased 87 percent. Imports of crude and semicrude aluminum rose 62 percent and exports were almost 6 times those in 1938 (3 times the previous record year, 1918). The quoted price of primary aluminum remained unchanged throughout 1939, but on March 25, 1940, the price was reduced from 20 to 19 cents per pound.

Domestic shipments and imports of bauxite likewise advanced in 1939. The larger demand came chiefly from the aluminum industry, but the abrasive, chemical, and other industries also increased their use of bauxite during the year. The greater production (shipments) of bauxite from Arkansas mines sufficed to increase the total for the United States 21 percent over that in 1938. Imports of bauxite exceeded those of any other year, increasing 14 percent over those in 1938. Exports (dried-ore basis) declined 4 percent. Apparent consumption increased 19 percent over that of 1938 and 7 percent over that of 1937, the previous peak. The domestic output was equivalent

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

to 45 percent and net imports to 55 percent of total consumption. The quoted range of prices for bauxite was slightly less than that in 1938.

Salient statistics of the bauxite and aluminum industries in the United States, 1937–39

	1937	1938	1939
Bauxite:			
Production (mine shipments) [1] long tons	[2] 425,076	[2] 310,916	375,307
Value [3]	$2,444,686	$1,812,545	$2,166,236
Imports [3] long tons	507,423	455,693	520,179
Exports (including concentrates) [3] do	123,191	57,726	51,635
World production do	3,700,000	3,801,000	[4] 4,300,000
Aluminum:			
Primary production short tons	146,341	143,441	163,545
Value	$55,609,000	$56,659,000	$64,600,000
Quoted price per pound [5] cents	20.1	20.0	20.0
Secondary production short tons	62,560	38,800	([6])
Imports	$8,177,600	$3,379,018	$4,766,260
Exports	$2,943,214	$5,484,047	$23,630,885
World production short tons	530,800	638,000	[4] 713,600

[1] Dried bauxite equivalent. [2] Revised figures. [3] As shipped. [4] Estimated.
[5] New York: 99 percent plus, pure virgin ingot, according to Metal Statistics 1940, published by American Metal Market. [6] Figures not yet available.

Although official data on world bauxite and aluminum production and trade are more incomplete than heretofore on account of hostilities in Europe and Asia, new high records are believed to have been established again in 1939. Estimated world output of aluminum increased 12 percent over 1938. The United States probably remained second to Germany as the largest producer of aluminum. Of the total world output, it is estimated that Germany contributed 28 percent, the United States 23 percent, Canada 12 percent, the U. S. S. R. 8 percent, and France 8 percent. The world race for supremacy in the air explained the outstanding demand for metal as consumption broke all previous records. Larger quantities of aluminum also were used in other transportation industries, in electric transmission lines, in many other established fields, and in new industrial uses developed by the industry's active research laboratories.

World bauxite output kept pace with aluminum production in 1939, increasing an estimated 14 percent. France's large output was followed by that of Hungary, Surinam, British Guiana, Italy, the United States, and Yugoslavia. The United States ranked sixth in importance and produced about 9 percent of the total.

BAUXITE

PRODUCTION

Bauxite production (mine shipments) in the United States increased 21 percent in quantity and 20 percent in value in 1939 compared with 1938 (fig. 1). Arkansas mines were responsible for all the increase as shipments from Alabama and Georgia decreased. Of the total domestic output, Saline and Pulaski Counties, Ark., contributed 96 percent, of which an estimated 60 percent came from underground mines and 40 percent from open-pit mines. Barbour and Henry Counties, Ala., and Sumter County, Ga., supplied the remaining 4 percent of the output, chiefly from open-pit operations.

Bauxite shipped from mines in the United States, 1935–39, by States

State and year	Long tons					Value f.o.b. mine, as shipped
	Crude	Dried	Calcined	Total		
				As shipped	Dried bauxite equivalent	
Alabama and Georgia:						
1935	100	14,021		14,121	[1] 14,114	$91,293
1936	91	16,971		17,062	[1] 17,056	109,327
1937	3,410	14,627		18,037	[1] 17,614	121,825
1938	5,532	[2] 12,542		18,074	[1] 17,253	132,882
1939	2,727	11,318		14,045	13,617	91,282
Arkansas:						
1935	21,594	164,349	33,848	219,791	[1] 231,331	1,465,302
1936	49,243	268,900	36,800	354,943	[1] 363,255	2,089,196
1937	98,340	257,023	46,832	402,195	[1] 407,462	2,322,861
1938	72,097	194,945	[3] 26,238	293,280	[1] 293,663	1,679,663
1939	99,215	225,355	[3] 36,686	361,256	361,690	2,074,954
Total United States:						
1935	21,694	178,370	33,848	233,912	[1] 245,445	1,556,595
1936	49,334	285,871	36,800	372,005	[1] 380,311	2,198,523
1937	101,750	271,650	46,832	420,232	[1] 425,076	2,444,686
1938	77,629	[2] 207,487	[3] 26,238	311,354	[1] 310,916	1,812,545
1939	101,942	236,673	[3] 36,686	375,301	375,307	2,166,236

[1] Revised figures. [2] Includes small quantity of activated. [3] Includes sintered.

The quantities in the foregoing and succeeding tables under the heading "As shipped" show the actual tonnage of material moved. Bauxite is shipped in several forms—crude, dried, activated, calcined, and sintered—in which the moisture content varies considerably; therefore all shipments must be converted to a common unit to permit correct interpretation of the statistical trend and more accurate comparisons of domestic production and shipments with imports and foreign production. This is accomplished by reducing all shipments to a "dried-bauxite equivalent," also listed in the tables.

Mine shipments which are used throughout this report to indicate production, formerly were classified according to use. These data, however, did not picture the true consumption in any particular year accurately, because of the large fluctuations in inventories held by some consumers who operate large processing plants near the mines to convert crude ore received from the mines into more concentrated products for delivery direct to places of ultimate consumption. The table showing shipments by uses has been modified this year to include bauxite shipped direct from the mines to ultimate consumers and that shipped from intermediate processing plants to final consumers. The variations in stocks held by processing plants thus have been eliminated, thereby giving a more accurate annual statement of consumption of domestic bauxite.

The dried bauxite shipped from Arkansas mines usually contains 55 to 60 percent Al_2O_3, 4 to 6 percent SiO_2, 2 to 4 percent Fe_2O_3, 2.5 to 3 percent TiO_2, and 27 to 30 percent combined moisture. The crude or undried ore normally contains 12 to 18 percent free moisture. The calcined bauxite contains about 80 to 84 percent Al_2O_3, 4 to 6 percent SiO_2, 5 to 8 percent Fe_2O_3, and 3.5 to 5 percent TiO_2. Ore shipped from Alabama and Georgia usually contains slightly less alumina and iron oxide and more silica than that from Arkansas. Stocks of bauxite on hand at all mines and processing plants on December 31,

1939, totaled 149,377 long tons of crude ore and 9,367 tons of processed ore compared with 99,800 tons of crude ore and 7,880 tons of processed ore on December 31, 1938.

Except for the Pulaski Bauxite Co., all bauxite producers and processing plants active in the United States in 1938 (Minerals Yearbook, 1939, p. 635) again operated mines and plants in 1939.

In Arkansas the American Cyanamid & Chemical Corporation developed the Heckler property, adjoining the Rauch mine, Pulaski County, and the Ozark No. 24 property, a few miles northeast of the Ozark No. 28 mine, Saline County. A bauxite-sintering plant was placed in operation at the Ozark No. 28 mine during the summer of 1939. Its equipment includes a crusher, screens, a standard Dwight-

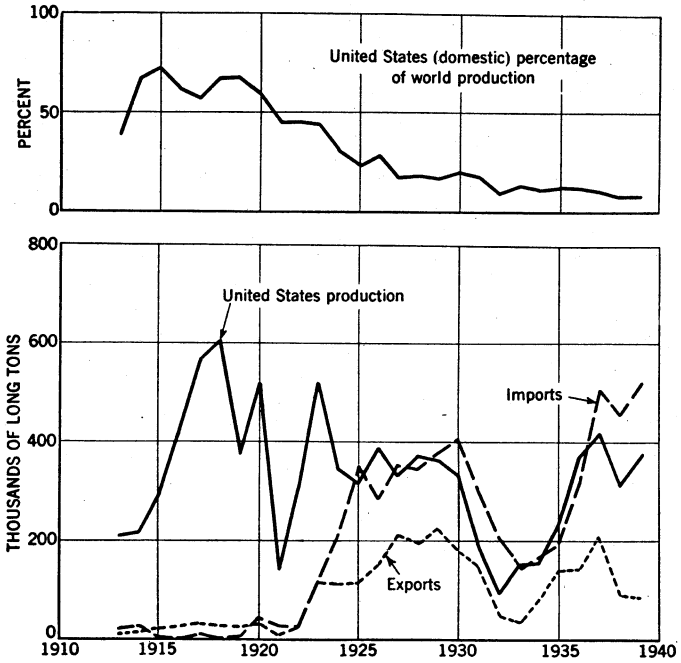

FIGURE 1.—Trends in production, imports, and exports of bauxite, 1913-39.

Lloyd sinter machine, and storage silos. The product is comparable in analysis and suitable for the same purposes as calcined bauxite. In the spring of 1939 the Porocel Corporation, owned jointly by the company and the Attapulgus Clay Co., began to produce activated bauxite at Berger, Ark., using a new dry process.

In 1939 the Arkansas Bauxite Corporation operated its McDonald mine and developed its Townsend property, both in Saline County. Operations ceased at the company Standard mine in April 1939 and at the Bizzell mine early in 1938. The company employs a special wet process at its activated bauxite plant at West Bauxite, which is owned jointly with Max B. Miller & Co., Inc. The Consolidated Chemical Industries, Inc., temporarily abandoned its Alexander No. 1 mine (Rogers Tract) near Bryant, Ark., in the fall of 1938 and began to produce bauxite from its No. 2 mine (Gates lease) near Mount

Olive early in 1939. The Crouch Mining Co., Inc., continued to operate the England mine, Pulaski County, in 1939, but planned to begin production in 1940 at the Young property, Saline County. The Dixie Bauxite Co., Inc., and the Republic Mining & Manufacturing Co. (the largest producer) produced ore in 1939 from the same properties operated in 1938. In Arkansas the Republic Co. mined bauxite from open-pit as well as from underground operations, while all other companies produced only from underground.

In Alabama, the Republic Co. continued to produce bauxite from various pocket deposits in the Eufaula district, Barbour and Henry Counties. The Floridin Co. also mined ore in this district, shipping it undried to its activated-bauxite plant at Quincy, Fla. In Georgia the American Cyanamid & Chemical Corporation shipped ore which had been mined in 1936 and 1937 from its drying plant, and Benjamin Easterlin installed a rotary drying kiln.

CONSUMPTION

Apparent consumption figures shown in the following tables differ from those published in previous reports of this series, inasmuch as they are based on shipments from mines and intermediate processing plants to ultimate consumers rather than shipments from mines irrespective of destination. Net imports (imports minus exports) comprised 55 percent of the apparent bauxite consumption in 1939 compared with 56 percent in 1938 and only 41 percent in 1937. (See fig. 1.) Canada takes most of the bauxite and alumina exported and uses a substantial quantity of it to manufacture crude abrasives, which are returned to the United States for final manufacture and consumption.

Data on production, imports, exports, and apparent consumption of bauxite in the United States from 1910 to 1938 were published in Minerals Yearbook, 1939, p. 636. These historical figures, however, as explained in the preceding paragraph, are not exactly comparable with those in the following table.

Shipments, imports, exports, and apparent consumption of bauxite in the United States, 1935–39, dried-bauxite equivalent, in long tons

Year	Domestic shipments to industry [1]			Imports	Exports	Apparent consumption
	From Arkansas	From Alabama and Georgia	Total			
1935	253,771	14,114	267,885	199,959	141,060	[2] 326,784
1936	352,919	17,056	369,975	322,790	144,445	[2] 548,320
1937	415,050	17,614	432,664	507,423	210,657	[2] 729,430
1938	275,078	17,253	292,331	455,693	90,341	[2] 657,683
1939	335,647	13,689	349,336	520,179	86,540	782,975

[1] From mines and processing plants. [2] Revised figures.

BY INDUSTRIES

Shipments of domestic bauxite to ultimate consuming industries from mines and processing plants are listed in the following table according to the condition actually shipped and the dried-bauxite equivalent. Detailed information is not available on the consump-

tion, by industries, of bauxite imported. Unless otherwise noted, all mention of production and consumption in the discussion that follows is in terms of dried bauxite.

Bauxite shipped from mines and processing plants in the United States, 1935–39, by consuming industries, in long tons

Industry	1935		1936		1937		1938		1939	
	As shipped [1]	Dried-bauxite equivalent	As shipped	Dried-bauxite equivalent	As shipped [1]	Dried-bauxite equivalent	As shipped [1]	Dried-bauxite equivalent	As shipped [1]	Dried-bauxite equivalent
Aluminum	112,154	112,154	194,764	194,764	209,476	209,476	144,208	144,208	161,008	161,008
Chemical	66,316	66,309	74,512	74,741	78,261	79,150	63,940	63,350	81,444	79,536
Abrasive [2]	51,566	86,889	63,654	98,069	88,685	135,849	48,999	74,614	55,346	82,326
Oil refining, refractory, [2] and other	1,758	2,533	1,680	2,401	7,107	8,189	10,332	10,159	14,238	26,466
Total quantity	231,794	267,885	334,610	369,975	383,529	432,664	267,479	292,331	312,036	349,336
Total value	$1,715,927		$2,282,301		$2,722,403		$1,823,307		$2,448,038	

[1] Includes crude, dried, and calcined, 1935-39: also activated, 1938-39, and sintered, 1939.
[2] Small quantity of bauxite shipped to makers of refractories probably included under "Abrasive."

Principal bauxite consumers [1] in the United States in 1939

Chemical manufacturers:
- Activated Alum Corporation, Baltimore, Md.
- Aluminum Ore Co., subsidiary of Aluminum Co. of America, Gulf Building, Pittsburgh, Pa.
- American Cyanamid & Chemical Corporation, 30 Rockefeller Plaza, New York, N. Y.
- American Phosphate & Mfg. Co., Sand Springs, Okla.
- Blockson Chemical Co., Joliet, Ill.
- Brown Co., Berlin, N. H.
- Brush Beryllium Co., Lorain, Ohio.
- Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.
- Consolidated Chemical Industries, Inc., Petroleum Building, Houston, Tex.
- Charles Cooper & Co., Newark, N. J.
- Davison Chemical Corporation, Rouse Building, Baltimore, Md.
- Diamond Alkali Co., Koppers Building, Pittsburgh, Pa.
- E. I. du Pont de Nemours & Co., Incorporated, 1007 Market Street, Wilmington, Del.
- Gaylord Container Corporation, Bogalusa, La.
- General Chemical Co., 40 Rector Street, New York, N. Y.
- Gulf Oil Corporation, Gulf Building, Pittsburgh, Pa.
- Hercules Powder Co., Wilmington, Del.
- Hilton-Davis Chemical Co., Langdon Farm Road & Pa. R. R., P. O. Box 8, Pleasant Ridge Station, Cincinnati, Ohio.
- Hooker Electrochemical Co., Niagara Falls, N. Y.
- William F. Jobbins, Incorporated, Aurora, Ill.
- Kalunite, Incorporated, 81 Navajo Street, Salt Lake City, Utah.
- Kimberly-Clark Corporation, Neenah, Wis.
- Charles Lennig & Co., Incorporated, 222 West Washington Square, Philadelphia, Pa.
- Mallinckrodt Chemical Works, St. Louis, Mo.
- Mineral Products Corporation, Marysvale, Utah.
- Monsanto Chemical Co., Everett, Mass.
- National Aluminate Corporation, 6216 West 66th Place, Chicago, Ill.
- Natural Products Refining Co., Jersey City, N. J.
- Niagara Chlorine Products Corporation, Box 96, Lockport, N. Y.
- Ohio Apex, Inc., Nitro, W. Va.
- Pennsylvania Salt Manufacturing Co., Widener Building, Philadelphia, Pa.
- Southwest Chemical Corporation, Little Rock, Ark.

[1] Some of the companies may consume aluminous raw materials other than bauxite. The list excludes oil-refining companies (chiefly in Pennsylvania and Mid-Continent fields), municipal water-treatment plants, and steel concerns that use bauxite.

Stauffer Chemical Co., 624 California Street, San Francisco, Calif.
S. D. Warren Co., Cumberland Mills, Maine.
Westvaco Chlorine Products, Incorporated, Carteret, N. J.
Other manufacturers:
Abrasive Co., Philadelphia, Pa.
Atlas Lumnite Cement Co., Chrysler Building, New York, N. Y.
The Carborundum Co., Niagara Falls, N. Y.
The Exolon Co., Blasdell, N. Y.
Federal Abrasives Co., Anniston, Ala.
General Abrasive Co., Inc., Niagara Falls, N. Y.
General Refractories Co., Philadelphia, Pa.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Laclede-Christy Clay Products Co., St. Louis, Mo.
Massillon Stone & Fire Brick Co., Massillon, Ohio.
Norton Co., Worcester, Mass.

Aluminum.—Shipments of bauxite from Arkansas to the aluminum industry in 1939 comprised 46 percent of the total domestic ore shipments. This quantity was relatively small, however, as almost three-fourths of the industry's bauxite requirements were imported from Surinam.

Abrasive.—In 1939, shipments of domestic bauxite to American and Canadian abrasive plants increased 10 percent from 1938, and amounted to 24 percent of the total tonnage. Technical advances made in the manufacture of abrasives have been very important in today's mass-production methods. Crystalline or fused aluminum oxide and silicon carbide are two standard abrasives that are hard enough to grind almost every material commonly used in the arts.[2]

Chemical.—Domestic bauxite consigned to the chemical industry increased 26 percent in 1939 and represented 23 percent of the total ore shipments. Shipments of aluminum salts advanced 20 percent and of alumina 3 percent. Returns from producers of primary aluminum salts and alumina show the consumption in 1939 of approximately 178,000 long tons of dried bauxite (58 percent domestic, 42 percent foreign), 8,546 short tons of alumina, 1,587 tons of aluminum, and a small quantity of clay, alunite, and chromite residue. Of the alumina shipped, 28 percent was used in the manufacture of aluminum salts.

Aluminum salts and alumina produced in the United States, 1938–39

	1938		1939	
	Producers	Short tons	Producers	Short tons
Aluminum salts:				
Alum:				
Ammonia	7	3,754	7	5,112
Potash	3	1,715	4	2,537
Aluminum chloride:				
Liquid	6	2,167	6	3,145
Crystal	2	6,240	4	8,340
Anhydrous	4		5	
Aluminum sulfate:				
Commercial:				
General	16	353,044	17	403,813
Municipal	10	10,278	10	11,239
Iron-free	8	15,082	9	23,640
Sodium-aluminum sulfate	2	24,961	2	31,545
Sodium aluminate	7		8	
Total aluminum salts		417,241		489,371
Alumina [1]	7	29,043	10	30,695

[1] Excludes alumina produced for use in making aluminum; includes activated, calcined, crude, light and heavy hydrate, and monohydrate D produced for sale.

[2] Tone, Frank J., Abrasives, 1918–38: Chem. Ind., vol. 45, No. 2, pt. 1, August 1939, pp. 133–139.

Aluminum salts and alumina shipped by producers in the United States, 1938–39

	1938				1939			
	Shippers	Short tons	Value		Shippers	Short tons	Value	
			Total	Average			Total	Average
Aluminum salts:								
Alum:								
Ammonia	7	4,079	$218,019	$53	7	5,570	$294,866	$53
Potash	3	2,085	121,174	58	5	2,709	156,358	58
Aluminum chloride:								
Liquid	6	2,174	99,208	46	6	3,121	136,792	44
Crystal	2	6,166	521,492	85	4	8,351	830,347	99
Anhydrous	4				5			
Aluminum sulfate:								
Commercial:								
General	16	349,051	7,345,471	21	17	408,324	8,031,897	20
Municipal	10	10,689	161,160	15	10	11,010	166,590	15
Iron-free	8	14,508	417,446	29	9	23,695	587,573	25
Sodium-aluminum sulfate	2	24,153	1,313,384	54	2	31,252	1,608,876	51
Sodium aluminate	7				8			
Total aluminum salts	-------	412,905	10,197,354	------	-------	494,032	11,813,299	------
Alumina [1]	7	29,175	1,955,383	67	11	30,178	2,143,522	71

[1] Excludes alumina produced for use in making aluminum; includes activated, calcined, crude, light and heavy hydrate, and monohydrate D.

Aluminum salts shipped in, imported into, and exported from the United States, 1935–39

Year	Domestic shipments		Imports		Exports			
					Aluminum sulfate		Other aluminum compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1935	402,717	$10,082,936	1,424	$68,636	33,091	$685,347	691	$126,435
1936	444,660	10,965,660	2,106	50,608	28,788	578,001	1,483	250,262
1937	466,894	12,092,992	2,864	61,665	31,807	679,214	2,609	423,363
1938	412,905	10,197,354	1,871	40,189	27,715	578,330	1,770	257,545
1939	494,032	11,813,299	828	22,335	34,734	744,755	1,792	208,455

Oil refining, refractory, and other.—The consumption of activated bauxite in the percolation filtration of paraffin-base oils continued to increase in 1939. The term "activated bauxite" refers to a product that has undergone more careful crushing, screening, sizing, beneficiating, and drying steps than most bauxite. There is no other specific treatment of the product that must have particular physical rather than chemical properties. The granular activated bauxite marketed usually contains 5 to 10 percent combined water and may be furnished in 20/60, 30/60, or some other special mesh grade, in bulk or in 100- or 125-pound bags. It is sold under the trade names Porocel, X-Yte, and Florite, at prices ranging upward from $33 per ton, f. o. b. Arkansas plants.

The very small percentage of bauxite reported shipped to the refractory industry probably is too low, as some products classed as abrasives are used chiefly because of their refractory properties. Aluminous refractories are fused electrically and cast economically in large blocks, and although particularly sensitive to thermal shocks,

high-density fused refractories have great chemical resistance at high temperatures.[3] These dense products are rigid and relatively brittle and do not withstand heat shock, therefore they are not widely applicable in the steel industry. Imported bauxite, chiefly from Greece, continued to be used in the domestic production of calcium aluminate cement. In 1939 small quantities of domestic dried and calcined bauxite were consumed by the steel industry as a fluxing material.

PRICES

In 1939 the average selling price, f. o. b. mines and processing plants, was $4.35 per long ton for crude (undried) bauxite; $5.36 for crushed dried bauxite; $12.48 for calcined bauxite; and $37.08 for activated bauxite. The average value for all grades of domestic ores as shipped by mine producers was $5.77 per ton ($5.82 in 1938).

Quotations on domestic and foreign bauxite are nominal, and a definite price per ton can be ascertained only by direct negotiation between the buyer and seller. The open market for bauxite is relatively small because some of the larger consumers operate their own mines and others obtain supplies on a contract basis. Quotations given in the following table are from Engineering and Mining Journal Metal and Mineral Markets.

Range of quotations on bauxite, 1937–39

Type of ore	Chemical specifications (percent)		Prices during year		
	Al_2O_3	SiO_2	1937	1938	1939
Domestic ore (per long ton):					
Chemical, crushed and dried [1]	55–58	[2]	$6.00–$7.50	$6.00–$7.50	$6.00–$7.00
Other grades [3]	56–59	5–8	6.00– 7.50	6.00– 7.50	6.00– 7.00
Pulverized and dried [3]	56–59	8–12	10.00–12.00	9.00–12.00	9.00–11.00
Abrasive grade, crushed and calcined [3]	78–84	[4]	12.50–15.00	12.00–15.00	12.00–14.00
Foreign ore (per metric ton):					
Dalmatian [5]	50–55	1–3	4.50– 7.50	6.00– 7.50	6.00– 8.00
Greek [5]	56–58	3–5	7.50– 8.50	7.00– 8.50	7.00– 8.00
French [5]	56–59	2–4	5.50– 9.00	7.00– 9.00	7.00– 8.00

[1] F. o. b. Alabama and Arkansas mines.
[2] SiO_2 not specified; Fe_2O_3, 1.5–2.5 percent.
[3] F. o. b. Arkansas mines.
[4] Not specified.
[5] C. i. f. Atlantic ports.

FOREIGN TRADE

Imports of bauxite (chiefly dried ore) in 1939 were the highest ever recorded (fig. 1), exceeding those received in 1938 by 14 percent and in 1937 (the previous peak) by 3 percent. Exports (dry equivalent) declined 4 percent compared with 1938. Of the 1939 imports Surinam supplied 477,094 long tons, British Guiana 29,586, Greece 8,190, France 5,280, and Netherland India 29. Imports, by custom districts, were as follows: 255,708 tons to Mobile, 189,341 to New Orleans, 40,104 to Philadelphia, 17,365 to Massachusetts, 8,190 to Chicago, 6,145 to Florida, 3,297 to Sabine, and 29 to New York. In addition to bauxite, 11 long tons of alumina were imported.

[3] Kraner, Hobart M., Alumina and Silica Refractories: Iron Age, vol. 145, Nos. 3 and 4, January 18 and 25, 1940, pp. 25–30 and 34–39.

Of the exports in 1939, 45,168 long tons were classified as bauxite and other aluminum ores, 6,372 tons as other bauxite concentrates, and 95 tons as alumina of which Canada was consigned 45,136 tons, 4,963 tons, and 93 tons, respectively. Of the remainder of "other bauxite concentrates," 900 tons went to Norway, 488 to Japan, 20 to Mexico, and 1 to Denmark.

Bauxite imported into and exported from the United States, 1935–39

Year	Imports for consumption [1] [2]		Exports (including bauxite concentrates) [3]		Year	Imports for consumption [1] [2]		Exports (including bauxite concentrates) [3]	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1935	199,959	$1,448,592	82,491	$2,191,167	1938	455,693	$3,521,325	57,726	$1,459,491
1936	322,790	2,370,778	84,471	2,322,915	1939	520,179	3,765,140	51,635	1,117,564
1937	507,423	3,609,063	123,191	3,456,916					

[1] Also "alumina" as follows: 1935, 67 long tons valued at $7,680; 1936, 117 tons, $11,618; 1937, 182 tons, $16,461; 1938, 64 tons, $5,464: 1939, 11 tons, $850.
[2] Chiefly dried ore.
[3] As shipped.

ALUMINUM

PRODUCTION

Primary.—Primary aluminum production in the United States in 1939 increased 14 percent in quantity and value over that in 1938 and was the largest on record (fig. 2). Output would have been greater had it not been for the unusually low rainfall in certain areas, which reduced the amount of power available. The value of aluminum produced averaged 19.75 cents per pound in 1939, the same as in 1938. Of the total output, 41 percent was made at Alcoa, Tenn.; 35 percent at Massena, N. Y.; 13 percent at Badin, N. C.; and 11 percent at Niagara Falls, N. Y.

Aluminum produced in the United States, 1935–39

Year	Primary metal		Secondary metal		Year	Primary metal		Secondary metal	
	Pounds	Value	Pounds	Value [1]		Pounds	Value	Pounds	Value [1]
1935	119,295,000	$22,070,000	102,800,000	$19,018,000	1938	286,882,000	$56,659,000	77,600,000	$15,326,000
1936	224,929,000	41,612,000	103,000,000	19,055,000	1939	327,090,000	64,600,000	(2)	(2)
1937	292,681,000	55,609,000	125,120,000	23,773,000					

[1] Based on average price of primary aluminum as reported to Bureau of Mines.
[2] Figures not yet available.

In 1939 the Aluminum Co. of America completed a $26,000,000 expansion program begun in 1937 and later announced the beginning of other developments to cost $30,000,000. A new aluminum-reduction plant to be finished about January 1, 1941, at Vancouver, Wash., will utilize Bonneville power and alumina shipped from existing plants, and it will be capable of producing 30,000 short tons of metal annually. This plant, together with a 20-percent increase in capacity of the Alcoa works, will enable the company to produce more than 215,000 tons of aluminum annually. In addition to the development of reduction

works, the new program will include: A bauxite beneficiating and drying plant at Paranam, Surinam, of 450,000 tons annual capacity; acquisition of additional ore-carrying vessels by the Ocean Dominion Steamship Co. to take care of increased bauxite shipments from South America; additions to the alumina works at Mobile, Ala., and East St. Louis, Ill.; hydroelectric station improvements along the Little Tennessee River; improved laboratory facilities; and enlarged manufacturing capacities at Alcoa, Tenn., Cleveland, Ohio, Lafayette, Ind., Los Angeles, Calif., Massena, N. Y., and New Kensington, Pa.

Early in 1940 the company began operating a powerful testing machine at New Kensington, Pa., capable of exerting a force of 3,000,000 pounds in compression and 1,000,000 pounds in tension at speeds as high as 36 inches per minute. To meet the increasing demand for aluminum from the aircraft industry, the company installed new production equipment and accumulated stocks in standard aircraft products. A 500-ton hammer for forging propellers, crankcases, and landing gears and a large corrugating press for the manufacture of airplane wings and other aluminum products were put in service. Other domestic fabricators of aluminum products also considerably expanded manufacturing facilities.

For the first time under the present capitalization, holders of common stock of the Aluminum Co. of America were paid a cash dividend in 1939 ($6.00 per share and a stock dividend on December 27). A second cash dividend was paid in 1940 ($1.00 per share on April 15). The consolidated net income of the company was $36,633,389 in 1939 compared with $15,563,145 in 1938.

Until June 1, 1939, the Government continued to present testimony (in District Court of the United States for the Southern District of New York) in support of its suit (filed April 23, 1937) asking dissolution of the Aluminum Co. of America, charging that it is a monopoly in violation of the antitrust laws. The court adjourned until June 21, when the company began to present its testimony which continued the rest of the year, except for the recess period ordered by Federal Judge Francis G. Caffey from August 4 to November 8, 1939. On September 13, 1939, the United States of America, through the Department of Justice, filed another suit against the company and two of its subsidiaries in the Federal District Court, New Orleans, La. This petition charges conspiracy to offset freight rates on bauxite from New Orleans to East St. Louis, Ill., in violation of the Elkins Act. This suit did not come to trial in 1939. On August 9, 1939, the Securities and Exchange Commission announced that the company and certain power subsidiaries were exempt from registration under the holding-company act on the ground that they were not public utility concerns.

On November 16, 1939, the Aluminum Co. of America signed 2-year contracts with two unions of the Congress of Industrial Organizations, which provide for some changes in working conditions and seniority ratings and affect plants at Alcoa, Tenn.; Edgewater, N. J.; New Kensington, Pa.; Detroit, Mich.; and Garwood, N. J. There are no company unions at any plants; and at Massena, N. Y., and East St. Louis, Ill., the unions of the American Federation of Labor are the bargaining agents. The company inaugurated a paid-vacation plan for employees in 1939 which will be continued in 1940.

Because of the interest in aluminum as a strategic material, historical data on production, imports, exports, and apparent consumption of

primary aluminum and production of secondary aluminum were included in Minerals Yearbook, 1939, pp. 642–643. Figures on production of primary aluminum are given from 1893 to 1938, other data from 1910 to 1938.

Secondary.—In 1939 the Bureau of Mines began revising its statistical canvass of the secondary-metal industries; owing to the extra

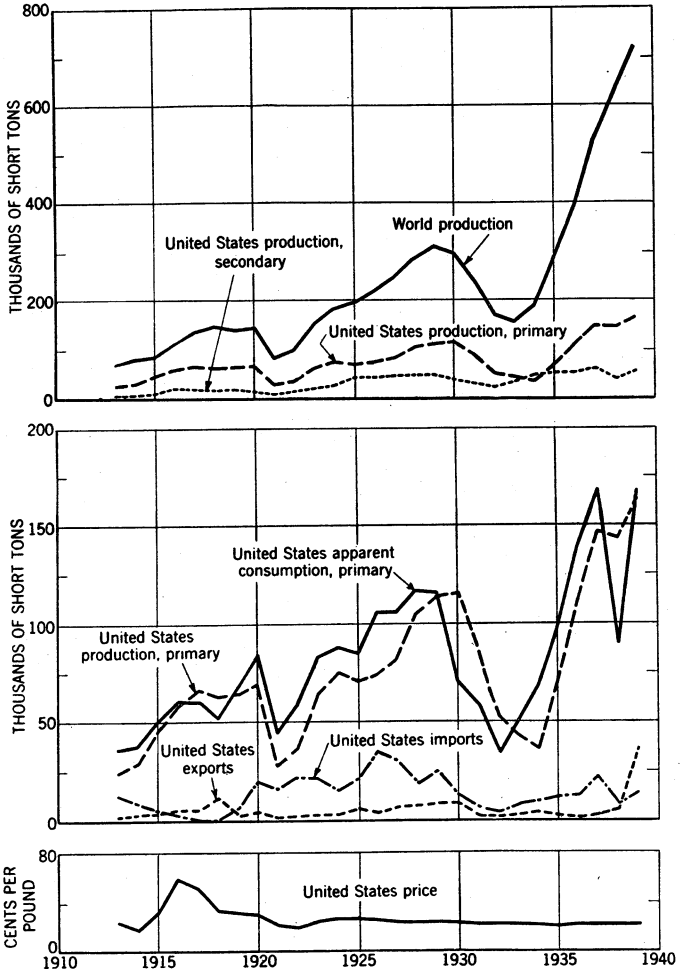

FIGURE 2.—Trends in production, imports and exports, apparent consumption, and average quoted prices of aluminum, 1913–39. Price is for No. 1 virgin 98–99 percent at New York through 1929, thereafter for 99 percent plus virgin ingot, as reported by American Metal Market.

time necessary for this revision, data on the output of secondary aluminum were not available when this report was prepared. It is believed, however, that the recovery of alloyed and unalloyed aluminum in 1939 approached the record high of 1937. Further details on secondary aluminum in 1939 are given in the chapter on Secondary Metals—Nonferrous, Minerals Yearbook, 1940.

CONSUMPTION

The apparent domestic consumption of primary aluminum in 1939 increased 87 percent over that in 1938 and was about the same as that in 1937, a record year (fig. 2). Secondary-aluminum consumption also increased substantially.

The abnormally large demand for aluminum in 1939 was attributable directly to the high rate of activity in the aircraft and other industries stimulated by military preparedness as well as hostilities abroad. Aluminum alloy comprises more than 60 percent of the structural or net weight of an airplane, and in 1939 the aviation industry consumed twice the quantity of aluminum that it did in 1937, the previous peak year. Consumption in this field is expected to set an even greater record in 1940.

The quantity of aluminum used for truck bodies in 1939 was double that of 1938, and that used for windows, spandrels, and other architectural purposes was 80 percent higher than in the previous year. Further progress is expected in use of the metal in the transportation, architectural, and numerous "borderline" fields as a result of the March 1940 price reduction, which gives aluminum a better price relationship with competing materials.

Production, imports, exports, and apparent consumption of primary aluminum and production of secondary aluminum in the United States, 1935–39, in pounds

Year	Primary aluminum				Secondary aluminum (production)
	Production	Imports	Exports	Apparent consumption[1]	
1935	119, 295, 000	[2] 21, 291, 235	3, 970, 347	191, 645, 888	102, 800, 000
1936	224, 929, 000	[2] 25, 562, 571	1, 605, 753	275, 443, 818	103, 000, 000
1937	292, 681, 000	[2] 45, 178, 069	5, 383, 516	335, 958, 553	125, 120, 000
1938	286, 882, 000	[2] 17, 740, 281	12, 618, 078	179, 045, 203	77, 600, 000
1939	327, 090, 000	18, 579, 940	73, 218, 080	335, 337, 860	[3]

[1] Data not available on fluctuations in consumers' stocks. Withdrawals from producers' stocks totaled 55,030,000 pounds in 1935, 26,558,000 in 1936, 3,483,000 in 1937, and 62,886,000 in 1939; additions to producers' stocks totaled 112,959,000 pounds in 1938.
[2] Crude and semicrude, some of which may be secondary aluminum.
[3] Figures not yet available.

The electrical conductor industry continued in 1939 to be second only to transportation as a major consumer of aluminum. The total mileage of aluminum cable, steel-reinforced, in the United States increased to 850,000 miles. More than 100,000 miles of cable were used in rural electrification, and over 1,000 miles of large-diameter cable were shipped for use in construction of the 220,000-volt power lines on the Bonneville Dam project. The strength of aluminum-alloy trains was tested in the severe wreck of the Union Pacific Railroad streamliner "City of San Francisco," when only 3 out of 17 cars were damaged enough to require replacement. Wider recognition of the permanence and insulating value of aluminum foil[4] resulted in its increased use, and in 1939 it was adapted to insulation of locomotive boilers. A single-purpose aluminum house paint was placed on the market, and aluminum-alloy automotive bearings were developed.

[4] Wilkes, Gordon B., Reflective Insulation: Ind. Eng. Chem., vol. 31, No. 7, July 1939, pp. 832–838.

From 1933 to 1938, inclusive, the percentage of aluminum used in various industries in the United States was approximately as follows: Transportation (land, air, and water), 29 percent; machinery and electrical appliance, 15; cooking utensil, 14; electrical conductor, 10; building construction, 8; food and beverage, 6; chemical, 5; iron and steel metallurgy, 5; miscellaneous foundry and metal working, 4; and general miscellaneous, 4.

PRICES

Throughout 1939 open-market quotations in New York for 99-percent-plus pure virgin ingot aluminum, delivered, remained unchanged at 20 cents a pound, carload lots. However, on March 25, 1940, the base price was reduced to 19 cents a pound for 10,000 pounds or more by the Aluminum Co. of America, which attributed the reduction to lowered production costs resulting from its extensive research and expansion program. Quotations for smaller lots down to 1 ton demand a ½-cent premium and for less-than-ton lots a 1-cent premium. The 1940 reduction also included a downward adjustment in prices of fabricated products. European quotations for aluminum ingot on December 30, 1939, were (converted into American money): 19.4 cents per pound in the United Kingdom, 24.2 cents in Germany, 15.6 cents in France, and officially 25.2 cents in Italy (actually 41 to 46 cents was the open-market price). According to Metal Statistics 1940, dealers' 1939 buying prices per pound in New York for principal grades of domestic aluminum scrap averaged 7.47 cents for cast aluminum and 13.90 cents for new-aluminum clips. The average selling price of remelted metal, 98½ to 99 percent grade, was 19.38 cents, and of No. 12 alloy, No. 2 grade, 13.28 cents.

FOREIGN TRADE

Crude and semicrude aluminum exports were nearly six times higher in 1939 than in 1938 and three times the previous peak reached in 1918 (12,068 short tons). The large increase in exports is attributed to defense and wartime demands and the abandonment by Canada of some of its world markets to the United States so that it could better supply the United Kingdom. In the middle of December 1939 the Government added aluminum, because of its use in the manufacture of aircraft, to the list of metals morally embargoed to countries for unprovoked bombing and machine-gunning of civilians. This measure chiefly affects Japan and the U. S. S. R. Of the exports of crude in 1939 (28,121 short tons), 9,933 tons went to the United Kingdom, 8,143 to France, 4,503 to Japan, 1,790 to the U. S. S. R., 1,378 to Belgium, and 551 to Germany; of scrap (476 tons), 364 tons went to Japan; and of semicrude (8,488 tons), 5,533 tons went to the United Kingdom, 1,721 to France, 366 to Canada, 359 to China, 146 to Japan, and 145 to Australia.

Aluminum imported for consumption in the United States, 1937–39, by classes

Class	1937		1938		1939	
	Pounds	Value	Pounds	Value	Pounds	Value
Crude and semicrude:						
Crude form, scrap, alloy, etc.	44,701,669	$6,770,400	17,511,819	$2,430,828	[1] 28,060,094	[1] $3,251,484
Plates, sheets, bars, rods, circles, squares, etc.	476,400	112,139	228,462	60,566	612,773	133,629
	45,178,069	6,882,539	17,740,281	2,491,394	28,672,867	3,385,113
Manufactures:						
Leaf (5½ by 5½ inches)	[2]	67,979	[2]	17,361	[2]	26,003
Powder in leaf (5½ by 5½ inches)	[3]	212			[3]	90
Bronze powder and powdered foil	295,299	124,276	186,418	77,425	110,995	42,959
Foil less than 0.006 inch thick	2,724,550	996,513	1,831,309	734,176	2,827,010	1,266,436
Table, kitchen, and hospital utensils, and other similar hollow ware	86,114	48,815	37,129	23,747	26,776	16,191
Other manufactures	[4]	57,266	[4]	34,915	[4]	29,468
	[4]	1,295,061	[4]	887,624	[4]	1,381,147
Grand total	[4]	8,177,600	[4]	3,379,018	[4]	4,766,260

[1] Includes 10,092,927 pounds of scrap valued at $760,913; not separately classified before 1939.
[2] 1937: 29,279,568 leaves; 1938: 8,389,969 leaves; 1939: 13,589,224 leaves; equivalent in pounds not recorded.
[3] 1937: 54,150 leaves; 1939: 70,000 leaves; equivalent in pounds not recorded.
[4] Quantity not recorded.

Aluminum exported from the United States, 1937–39, by classes

Class	1937		1938		1939	
	Pounds	Value	Pounds	Value	Pounds	Value
Crude and semicrude:						
Ingots, scrap, and alloys	4,719,034	$967,342	9,670,398	$1,860,796	[1] 57,194,509	[1] $11,693,276
Plates, sheets, bars, strips, and rods	664,482	293,453	2,947,680	2,050,995	16,975,233	9,178,275
	5,383,516	1,260,795	12,618,078	3,911,791	74,169,742	20,871,551
Manufactures:						
Tubes, moldings, castings, and other shapes	588,960	279,361	576,377	313,758	1,366,218	929,131
Table, kitchen, and hospital utensils	765,810	411,864	672,290	364,240	537,532	302,406
Foil	422,850	121,269	144,999	66,771	1,133,031	488,010
Aluminum and aluminum bronze powder	316,482	114,760	82,232	33,944	182,323	80,960
Other manufactures of aluminum	[2]	755,165	[2]	793,543	[2]	958,827
	[2]	1,682,419	[2]	1,572,256	[2]	2,759,334
Grand total	[2]	2,943,214	[2]	5,484,047	[2]	23,630,885

[1] Includes 951,662 pounds of scrap valued at $160,283; not separately classified before 1939.
[2] Quantity not recorded.

Imports of crude and semicrude metal were 62 percent higher than in 1938 but for the first time since 1918 were less than exports. Imports (exclusive of scrap) comprised only 6 percent of the apparent consumption of primary aluminum in 1939. Of the imports of crude

(8,984 tons), 3,766 tons came from Canada, 2,083 from Norway, 1,666 from France, and 1,125 from Switzerland; of scrap (5,046 tons), 3,475 tons came from the United Kingdom and 1,167 from France; and of semicrude (306 tons), 225 came from the United Kingdom and 75 from Switzerland. The value of aluminum manufactures exported increased 76 percent and of those imported 56 percent.

TECHNOLOGIC DEVELOMENTS

An outstanding development during 1939 was the successful brazing of aluminum alloys. Brazing differs from welding primarily in that no substantial quantity of the parent material is melted. Although the strength of brazed and torch-welded joints is about the same the cost is reduced, neater joints are provided requiring less finishing, and thinner parts can be joined by brazing.[5] Furnace-, torch-, and dip-brazing methods have been devised, which use filler materials (aluminum-base alloys) and fluxes melting and flowing at temperatures (1,050° to 1,185° F.) below that of the parent material.

A new aluminum-base die-casting alloy (Alcoa 218) containing 8 percent magnesium is said to have high strength and resistance to corrosion.[6] Alclad (72S)3S, a comparatively new wrought product, is particularly suited for combating localized corrosion and perforation.

Some of the other recent technologic developments in regard to aluminum include work on anodic coating and electroplating of aluminum alloys (Travers process),[7] aluminum-coated steel,[8] and the property of aluminum of restricting grain growth in steel metallurgy.[9]

WORLD BAUXITE AND ALUMINUM INDUSTRIES

BAUXITE PRODUCTION

World production of bauxite continued to increase and in 1939 established another new record. Output is estimated as 4,400,000 metric tons, a 14-percent increase over 1938. The principal producing countries, in the probable order of importance, were: France, Hungary, Surinam, British Guiana, Italy, United States, Yugoslavia, U. S. S. R., and Netherland India. Reports indicate that in 1939 the Unfederated Malay States increased bauxite output approximately 67 percent, Surinam 34 percent, British Guiana 27 percent, United States 21 percent, Hungary 18 percent, France 17 percent, and Italy 16 percent, while Yugoslavia decreased production 21 percent.

[5] Hoglund, G. O., Brazing the Aluminum Alloys: Ann. Meeting, American Welding Soc., Chicago, October 23–27, 1939.

[6] Dix, E. H., Jr., Aluminum and Its Alloys: Metal Progress, vol. 36, No. 4, October 1939, pp. 355–356.

[7] Edwards, Junius D., Anodic Coating of Aluminum: Internat. Convention, Am. Electroplaters' Soc., June 1939, 22 pp.
Bregman, Adolph, Electroplating on Aluminum: Iron Age, vol. 145, No. 6, February 8, 1940, pp. 40–42.

[8] Allen, A. H., Mirrors of Motordom: Steel, vol. 104, No. 14, April 3, 1939, p. 30.

[9] McQuaid, H. W., The Use of Aluminum for the Control of Grain Size in Commercial Steels: Metals Handbook, 1939, pp. 810–813.

World production of bauxite, 1935–39, by countries, in metric tons

[Compiled by M. T. Latus]

Country	1935	1936	1937	1938	1939
Australia:					
New South Wales	111		6,793	442	(1)
Victoria	1,064	752	1,097	1,341	(1)
Brazil (exports)		7,000	8,770	12,928	(1)
British Guiana (exports)	113,290	172,884	305,533	382,409	483,652
Czechoslovakia			846	(1)	(1)
France	512,850	649,500	688,200	682,440	(1)
Germany	8,547	12,425	18,212	19,703	(1)
Greece	9,489	129,898	137,412	179,886	(1)
Hungary	211,079	329,091	532,657	540,718	(1)
India, British	7,758	3,702	15,393	15,005	(1)
Indochina		30	7,000	160	(1)
Italy	170,064	262,246	386,495	360,837	(1)
Netherland India	16,708	133,731	198,970	245,354	(1)
Portuguese East Africa	30	29			(1)
Rumania	6,218	10,829	10,701	11,807	(1)
Surinam (Dutch Guiana)	112,682	234,845	392,447	377,213	504,062
Unfederated Malay States: Johore		37	19,305	55,965	93,740
U. S. S. R.	132,000	203,200	[2] 230,000	[2] 250,000	(1)
United States (dried bauxite equivalent)	249,384	386,415	431,898	315,906	381,331
Yugoslavia	216,197	292,174	354,233	396,368	314,439
	1,767,000	2,829,000	3,746,000	3,849,000	(1)

[1] Data not available.
[2] Estimated.

ALUMINUM PRODUCTION

World aluminum production continued to rise and in 1939 reached a new peak despite the general shortage of hydroelectric power in much of the Northern Hemisphere. Production is estimated as approximately 650,000 metric tons, an increase of 12 percent over 1938. Germany is believed to have remained the principal producer, accounting for an output 21 percent greater than that of the United States. Estimates for 1939 indicate that Japan increased its metal output 35 percent, Italy 16 percent, Canada, the U. S. S. R., and the United States each 14 percent, France 10 percent, and the United Kingdom and Norway each 7 percent.

World production of aluminum, 1935–39, by countries, in metric tons

[Compiled by R. B. Miller]

Country	1935	1936	1937	1938	1939
Canada	21,400	26,200	41,700	66,000	75,000
France	22,000	29,700	34,500	45,300	50,000
Germany	70,800	97,200	127,200	161,100	(1)
Austria	2,500	3,300	4,400	4,500	(1)
Hungary	300	800	1,000	1,500	1,500
Italy	13,800	15,900	22,900	25,800	30,000
Japan	4,400	7,000	10,000	17,000	23,000
Norway	15,000	15,400	23,000	29,000	31,000
Spain	1,200	600		800	(1)
Sweden	1,800	1,800	1,800	2,400	(1)
Switzerland	11,700	13,700	25,000	27,000	28,000
U. S. S. R.	25,500	30,000	37,700	43,800	(1)
United Kingdom	15,100	16,300	19,300	23,300	25,000
United States	54,100	102,000	132,800	130,100	148,400
Yugoslavia			200	1,200	(1)
	259,600	359,900	481,500	578,800	647,400

[1] Estimate included in total.

ALUMINUM CONSUMPTION

According to the Metallgesellschaft, world consumption of aluminum in 1938 totaled 515,100 metric tons, a 3-percent increase over 1937. Of the total, Germany accounted for 34 percent and all of Europe for 74 percent. The absence of complete official production and foreign trade statistics does not permit a reliable estimate of apparent consumption by countries for 1939, but it is safe to say that an all-time record was established, chiefly because of the military demand for the metal. The apparent primary consumption of the United States in 1939 totaled 152,100 metric tons (152,400 in 1937 and 81,200 in 1938), 14 percent less than that consumed by Germany in 1938 (176,600 tons). During recent years world aluminum-consuming countries have tended to become more self-sufficient in regard to metal output but more dependent on foreign sources for bauxite.[10]

REVIEW BY COUNTRIES

When hostilities were begun in Europe and Asia, many countries ceased to publish statistical information and therefore only incomplete and estimated data for 1939 regarding production, trade, and developments are available for some nations. Official foreign trade statistics, however, are available on the European belligerents for the first 7 or 8 months of 1939. Since the outbreak of the wars both neutral and belligerent countries have issued various restriction decrees, particularly in regard to exports of strategic materials. Permits or licenses are necessary to export bauxite, alumina, or aluminum from the United Kingdom and France and their possessions (including Canada, Australia, British Guiana, Unfederated Malay States, and British India), and from Germany, Greece, Italy, Japan, Norway, Yugoslavia, and other countries.

British Guiana.—Bauxite production in 1939 aggregated 477,693 metric tons of ore containing 60 percent or more Al_2O_3 and 82,932 tons containing 30 to 50 percent Al_2O_3. Exports, chiefly to Canada, the United Kingdom, and the United States, totaled 483,652 tons in 1939 (382,409 in 1938). The Demerara Bauxite Co. extended mining operations to both banks of the Demerara River, and an investigation was made of bauxite occurrences in the Essequibo and Northwest districts of British Guiana.

Canada.—Production and exports of aluminum broke all previous records in 1939. Of the 1939 exports (64,028 metric tons), 35,342 tons went to the United Kingdom, 19,089 to Japan, 2,629 to Germany, 1,800 to the United States, 1,500 to France, 1,078 to China, and 818 to Poland and Danzig. Of the bauxite imported in 1939 (459,924 tons), 405,214 tons came from British Guiana and 54,693 from the United States. Alumina (89 tons) came from the United States and the United Kingdom and cryolite (3,128 tons) from Greenland and the United States.

In the summer of 1939 the Aluminum Co. of Canada, Ltd., began a $7,000,000 expansion program to be completed by May 1940, which included a 15-percent increase in reduction capacity at Arvida and Shawinigan Falls, Quebec (apparently bringing total annual capacity to 100,000 tons). Other recent construction includes a new fabrica-

[10] Anderson, Robert J., Primary Aluminium: Mining Mag. (London), vol. 60, No. 4, April 1939, pp. 206–209.

tion plant near Kingston, Ontario, and a plant at Arvida for the manufacture of Alpaste, an aluminum paint pigment. Early in 1940 the British Government contracted for the entire exportable surplus of aluminum in Canada during 1940 and 1941, or about 90 percent of the output. Apparently, the Government also agreed to finance a further expansion of the aluminum industry. Permits and licenses are required for the exportation of bauxite, alumina, aluminum, and artificial abrasives from Canada.

France.—French bauxite production in 1939 is estimated as 800,000 metric tons. During the first 7 months of 1939 France exported 237,438 tons of bauxite, of which 166,069 were to the United Kingdom, 46,368 to Germany, 14,168 to Sweden, 5,365 to the United States, and the remainder to others. Alumina exports for the same period totaled 19,023 tons, of which 9,762 went to Norway and 9,246 to Switzerland. For the same period in 1938 France exported only 171,259 tons of bauxite and 9,970 tons of alumina.

Germany.—Decrees issued in the fall of 1939 restrict the consumption of light metals and their alloys and limit the expansion of the aluminum industry in Germany. Both decrees probably were influenced by difficulties experienced in obtaining enough electric energy because of the shortage of hydroelectric power in Bavaria and Austria and the inadequate supplies of coal at steam power plants and the limited equipment available for plant extensions. Thus handicapped, it is believed that German and Austrian output of aluminum in 1939 totaled only about 180,000 metric tons instead of the planned 200,000 tons. If land and Danube River transport facilities are available and high prices are no hindrance, the German aluminum industry should not lack adequate supplies of bauxite because of the British-French blockade, as large reserves of aluminum ore are available in Hungary and the Balkans. Despite apparent interruptions in Yugoslav and Greek shipments in 1939, it is estimated that German bauxite imports exceeded 1,100,000 tons. During the first 7 months of 1939 Germany imported 645,149 tons of bauxite, 4,940 tons of crude aluminum, and 2,749 tons of aluminum scrap. Of the bauxite imported, 223,445 tons came from Hungary, 201,555 from Yugoslavia, 63,617 from Greece, 57,570 from Netherland India, 47,678 from France, 45,542 from Italy, and 5,742 from Denmark (probably cryolite).

Recent German expansions include an alumina and aluminum-reduction works (Lippewerk) at Lünen, Westphalia, with an annual capacity of 40,000 tons of metal, and an 8,000-ton alumina plant at Lautawerk which decomposes German clay with sulfurous acid.[11]

Greece.—Of 178,811 metric tons of bauxite exported in 1939 (139,245 in 1938), 89,622 tons went to Germany, 34,074 to Norway, 23,959 to Japan, and 19,335 to the United Kingdom. The Hellenic-Hydro-Electric Metallurgical Co. (American) plans to construct an alumina and aluminum-reduction plant in Greece, using power transmitted from the Acheloos River Falls to Hea. Despite low production costs Greece reports difficulty disposing of all its bauxite output, and large stocks accumulated in 1939.

[11] Metall und Erz (New Methods of Light-metal Production): Vol. 36, No. 3, 1939, pp. 63–72; also vol. 35, No. 19, 1938, pp. 499–510.
Singer, F., Methods of Extracting Alumina from Clay: Brick and Clay Record, vol. 94, No. 6, June 1939, pp. 54–58.

Hungary.—In 1939 bauxite exports (probably all to Germany) totaled 570,170 tons. The new aluminum-reduction plant of the Hungarian United Coal Mining Co., Ltd., at Tatabanya (Totis) began operating early in 1940, and a third Hungarian plant is proposed by the Hungarian Bauxite Trust and the Vereinigte Glühlampen und Elektrizitäts A.-G. for the Bakony district.

Italy.—Although the bauxite reserves of Italy (in Istria and in central and southeastern parts) are estimated to exceed 34,000,000 metric tons, two-thirds of this quantity is high in silica and unsuitable for the Bayer alumina process.[12] Montecatini recovers vanadium from the caustic soda solution in the Bayer process and uses a portion of the red mud in the production of pig iron by means of sintering and the electric arc furnace.[13]

Japan.—Productive capacity of the six established Japanese aluminum companies at the end of 1938 was about 27,000 metric tons. On the basis of reported and estimated exports from Netherland India, Unfederated Malay States (Johore), Greece, Palao Island, and British India, Japanese bauxite imports approached 300,000 tons in 1939. Japanese interests have developed bauxite deposits on Palao Island, though shallow in depth, and on Hainan Island, which were rejected previously by British interests because of their low grade. Most of the older Japanese aluminum companies have ceased to experiment with unsuitable low-grade ore (alunite, shale, etc.) and have turned to imported bauxite despite the Government subsidy recently granted those using Empire raw materials. Under the recently enacted national policy bill, new firms are accorded preferred financing methods, certain tax exemptions, and free import privileges, but the Government controls production through licensing and can require plant experimental work.[14] So far, national expansion of the industry has been much slower than desired because of the shortage of coal, hydroelectric power, and coke, as well as slow equipment deliveries. In 1939 more than 28,000 tons of aluminum were exported to Japan from Canada, the United States, Norway, and Switzerland compared with approximately 21,500 tons in 1938.

Netherland India.—Bauxite exports in 1939 totaled 217,630 metric tons, of which 168,428 tons went to Japan and 49,072 to Germany. The N. V. Billiton Maatschappij began constructing a hydroelectric plant on the Asahan River, Sumatra, below Toba Lake, and later alumina (20,000-ton capacity annually) and aluminum-reduction works (5,000-ton capacity) will be built at Tandjong Balei, Sumatra.

Norway.—In 1939 imports of bauxite totaled 32,697 metric tons (25,942 in 1938) and of alumina, 45,639 tons (43,737 in 1938). Crude aluminum exports decreased from 28,577 tons in 1938 to 24,084 in 1939, of which 3,420 tons went to Japan, 2,799 to the United Kingdom, 2,242 to Sweden, 1,800 to Poland and Danzig, 1,727 to France, 1,775 to the U. S. S. R., 1,669 to Denmark, 1,600 to Switzerland, and 1,437 to the United States.

Surinam.—The N. V. Billiton Maatschappij has abandoned its plans to mine bauxite in Surinam.

[12] Anderson, Robert J., The Aluminium Industry of Italy: Mining Mag. (London), vol. 61, No. 1, July 1939, pp. 13–27.
[13] Light Metals, Light Alloys and the Light Metal Industries in Italy: Vol. 3, No. 27, April 1940, pp. 103–106.
[14] Bureau of Mines, Mineral Trade Notes: Vol. 9, No. 6, December 20, 1939, pp. 3–9.

Sweden.—The A. B. Swenska Aluminium Kompaniet will erect an alumina plant, using a corundum type of ore found at the Boliden gold mines or imported bauxite, and has increased capacity of its reduction plant at Månsbo 80 percent.

U. S. S. R.—The hitherto unsatisfactory progress of the Russian aluminum industry is attributed to a shortage of electrical power, obsolete equipment, high sulfur content (2.5 percent) in the alumina produced as blast-furnace slag,[15] and other difficulties.[16] Except for a few deposits in the Urals, most of the Russian bauxite reserves,[17] estimated at 53,000,000 tons, consist of low-grade ore. Bauxite from Turinsk is employed in the new Bayer alumina and the aluminum-reduction plant at Kamensk in the Urals, which produced its first half ton of metal in September 1939. During the fall of 1939 the first unit of the alumina plant at Kirovsk, Kola Peninsula, was scheduled to begin utilizing nepheline tailings from apatite ore. This alumina is to be shipped to the enlarged Volkhov reduction works.

Thermic silumin, an aluminum-silicon alloy, is to be produced direct from the ore in Miguet furnaces at the Dnepr reduction plant as soon as higher-grade raw material (kaolin, kyanite, etc.) is available and the iron content of the alloy can be reduced. In 1940 the U. S. S. R. plans to complete the Sosnovets reduction works south of Kandalaksha and to produce 90,000 tons of metal. Metal output is estimated as only 50,000 tons in 1939.

Switzerland.—In 1939 exports of virgin aluminum ingots, etc., totaled 14,930 metric tons (21,814 in 1938) and of bars, sheets, stampings, etc., 3,299 tons. Aluminum-alloy ingots, etc., exported aggregated 5,450 tons, and other aluminum fabrications comprised 6,942 tons. Of the 14,930 tons of new metal exported, 10,885 tons were consigned to the United Kingdom, 1,090 to Belgium, 789 to Germany, 670 to Japan, and 600 to the United States. The Aluminium Industrie A.-G., Neuhausen, regrouped all its affiliated companies early in 1940 because of the European hostilities and became a holding company for financing its subsidiaries.

Unfederated Malay States: Johore.—Three open-pit mines—the Bukit Pasir and Sri Medan mines near Batu Pahat and the Sungei Kim Kim mine near Pulau Nanas—produced bauxite in 1939.[18] Virtually all the 85,745 metric tons of washed, undried ore exported in 1939 went to Japan through the ports of Batu Pahat and Penggerang. The Pasir ore contains 53 to 61 percent Al_2O_3, 2 to 4 percent SiO_2, 6 to 16 percent Fe_2O_3, 1 percent TiO_2, and 27 to 30 percent combined water, while the average Kim Kim ore contains 55.5 percent Al_2O_3, 6.5 percent SiO_2, 9 percent Fe_2O_3, 0.25 percent TiO_2, and 29 percent combined water.[19]

United Kingdom.—Early in 1940 the British Government apparently agreed to finance aluminum production and fabrication facilities in addition to those completed by the British and Canadian industries during 1939. To satisfy the strong demand for aluminum by the air-

[15] Bureau of Mines, Mineral Trade Notes: Vol. 10, No. 3, March 1940, p. 3.
[16] Reidemeister, von F., Die Aluminium-lage in der U. S. S. R.: Aluminium (Berlin), vol. 21, No. 11, November 1939, pp. 793–798.
[17] U. S. S. R. All Union Scientific Research Institute of Economic Mineralogy, Bauxite: Trans., Nos. 110, 112, 120, and 151; 1937, 1938, and 1939.
[18] Imperial Institute, Progress in Colonial Mineral Industry: Bull., vol. 37, No. 2, April-June 1939, pp. 270–271.
[19] Fermor, L. L., Report upon the Mining Industry of Malaya: 1940, pp. 17, 32–33, 194, 202.

craft and other war industries, orders were placed with Canada, the United States, Switzerland, and Norway. Soon after war was declared against Germany in September 1939, the Ministry of Supply assumed control of supplies and prices of aluminum, invoking a licensing system and prohibiting delivery of metal except in fulfillment of Government or existing written contracts. Export licenses were required from the Board of Trade; on October 10 imports of aluminum were added to the free list, and on February 1, 1940, imports became subject to license. On November 24 the Ministry of Supply became the sole vendor of aluminum; it raised the price on primary metal from £94 to £110 per long ton, delivered, and withdrew the maximum price control on aluminum scrap.

Foreign trade statistics are available only for the first 8 months of 1939, and imports during this period totaled 35,412 metric tons of crude aluminum and its alloys; 8,004 metric tons of sheets, plates, circles, bars, etc.; and 231,443 long tons of bauxite. Of the crude and alloy aluminum imported, 24,461 tons came from Canada, 10,123 from Switzerland, and 539 from Norway.