BAUXITE AND ALUMINA

By Patricia A. Plunkert

Domestic survey data and tables were prepared by Micheal George, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Bauxite is a naturally occurring, heterogeneous material comprised primarily of one or more aluminum hydroxide minerals plus various mixtures of silica (SiO_2), iron oxide (Fe_2O_3), titania (TiO_2), aluminosilicates (clay, etc.), and other impurities in trace amounts. The principal aluminum hydroxide minerals found in varying proportions within bauxite are gibbsite [$Al(OH)_3$] and the polymorphs, boehmite and diaspore [both AlO(OH)].

Bauxite is typically classified according to its intended commercial application, such as abrasive, cement, chemical, metallurgical, and refractory. Of all bauxite mined, approximately 85% is converted to alumina (Al_2O_3) for the production of aluminum metal, an additional 10% goes to nonmetal uses as various forms of specialty alumina, and the remaining 5% is used for nonmetallurgical bauxite applications. The bulk of world bauxite production is, therefore, used as feed for the manufacture of alumina via a wet chemical caustic leach process known as the Bayer process. The majority of the alumina produced from this refining process is smelted using the Hall-Héroult process to produce aluminum metal by electrolytic reduction in a molten bath of natural or synthetic cryolite ($NaAlF_6$).

Specifications for the nonmetallurgical grades of bauxite are more stringent than those for bauxite used to produce metal and are based on the processing requirements and special properties required of their final commercial products. The natural chemical impurities that exist within these specialty-grade raw materials are not chemically removed by refining as is the case for metallurgical-grade bauxite. Nonmetallurgical ores in an essentially unrefined chemical form are used as direct feed for the production of their ultimate end products. Although figures on bauxite production and consumption within nonmetallurgical markets are not commonly available, the principal industrial end uses for nonmetallurgical-grade bauxite are considered to be in refractories and abrasives, followed by cement applications. In addition, the aluminum chemicals and steel industries also consume significant quantities of bauxite.

In 2000, 22 countries reported bauxite mine production, and total world production increased by 6% compared with that of 1999. Australia, Brazil, Guinea, and Jamaica accounted for about 70% of the total bauxite mined in 2000. The principal sources of nonmetallurgical-grade bauxite are limited to only a handful of countries: abrasive grade is produced in Australia, China, Greece, Guinea, Guyana, and Italy; refractory grade, in Brazil, China, and Guyana (Russell, 1999, p. 49, 58).

Total reported world reserves of bauxite are sufficient to meet cumulative world primary aluminum metal demand well into the 21st century. Although bauxite reserves are unevenly

Bauxite and Alumina in the 20th Century

In 1900, bauxite in the United States was mined in three States—Alabama, Arkansas, and Georgia. Production that year was about 23,600 metric tons. World bauxite production in 1900 totaled 88,000 tons and was derived from three countries; the largest producer was France (58,500 tons), followed by the United States and the United Kingdom (5,870 tons). Even in 1900, the United States was not self-sufficient in bauxite and imported 8,790 tons of bauxite, approximately 28% of U.S. consumption. Bauxite was used mainly for the manufacture of aluminum, although a considerable quantity was used for the manufacture of aluminum sulfate and crystalized alum. In order to produce aluminum commercially, bauxite was converted to alumina by the Bayer process, which was patented by Karl Josef Bayer in 1888 and is still used today. Data on domestic and world production levels of alumina in 1900 are not available. Reports, however, indicate that the Pittsburgh Reduction Company (Alcoa Inc.) operated an alumina plant in New Kensington, PA, in 1900.

In 2000, bauxite production in the United States was negligible and was used for nonmetallurgical applications. World bauxite mine production totaled about 135 million metric tons. Of the 22 countries that reported mine production, Australia, Brazil, Guinea, and Jamaica accounted for about 70% of the production. Of the bauxite mined worldwide, about 85% was converted to alumina by the Bayer process for producing aluminum metal. An additional 10% was used in nonmetallurgical applications in various forms of specialty alumina, and the remaining 5% was used for nonmetallurgical bauxite applications, such as abrasives, refractories, cement additives, and aluminum chemicals.

Domestic production of alumina in 2000 was derived almost exclusively from imported metallurgical-grade bauxite. An estimated 90% of the alumina shipped by U.S. refineries went to domestic primary smelters for aluminum metal production. Consumption by the abrasive, chemical, refractory, and specialty industries accounted for the remainder. Despite being one of the four largest alumina producers in the world, the United States depends on alumina imports for about one-half of its metallurgical requirements. Of the 28 countries that produced a total of more than 49 million tons of alumina, Australia dominated the industry and accounted for about one-third of total world production.

distributed throughout the world, with approximately 90% in about a dozen countries, the sheer magnitude of these reserves (25 billion metric tons) is sufficient to ensure a readily accessible supply for the future (Plunkert, 2001).

U.S. production of alumina (calcined equivalent), derived almost exclusively from imported metallurgical-grade bauxite, decreased by 7% in 2000 compared with that of 1999. An estimated 90% of the alumina shipped by U.S. refineries went to domestic primary smelters for aluminum metal production. Consumption by the abrasives, chemicals, refractories, and specialties industries accounted for the remainder of U.S. alumina shipments.

World output of alumina increased 5% in 2000. The principal producing countries, in descending order of alumina output, were Australia, the United States, China, and Jamaica. These countries accounted for almost 60% of the world's production; Australia alone accounted for about one-third of total world production.

Legislation and Government Programs

In September, the Defense Logistics Agency (DLA) released its Annual Materials Plan (AMP) for the National Defense Stockpile (NDS) for fiscal year 2001. The 2001 AMP, including its subsequent revisions, provided for the sale of 3.05 million metric tons (Mt) (3 million long tons) of metallurgical-grade bauxite, of which 2.03 Mt (2 million long tons) was Jamaica type and 1.02 Mt (1 million long tons) was Suriname type (Defense Logistics Agency, 2000a). Also, as part of the plan, the DLA was authorized to dispose of 5,080 calcined tons (5,000 long calcined tons) of refractory-grade bauxite in fiscal year 2001 (Defense Logistics Agency, 2001b). These were the maximum amounts recommended for disposal during the fiscal year, and the actual level of sales was to be dependent upon the prevailing market conditions.

During calendar year 2000, the DLA announced the following sales of bauxite from the NDS: 10,200 metric tons (t) (10,000 long tons) of metallurgical-grade bauxite, Jamaica type, for a provisional value of $45,000 to Bulk Materials International (Defense Logistics Agency, 2000b); and 680,000 t (669,000 long tons) of metallurgical-grade, Suriname type, for an estimated value of $5.11 million to Alcoa Inc. and Bulk Materials Inc. (Defense Logistics Agency, 2000c).

At yearend, the NDS uncommitted inventory for metallurgical-grade bauxite was 5.5 Mt (5.42 million long tons) of Jamaica type and 201,000 t (197,000 long tons) of Suriname type. The NDS calcined refractory-grade bauxite inventory was 2,520 calcined tons (2,480 long calcined tons) (Defense Logistics Agency, 2001a).

Production

On May 3, Alcoa Inc. and Reynolds Metals Co. announced that the U.S. Department of Justice (DOJ) and the European Union (EU) had approved their proposed merger and that the merger had been completed. Reynolds shareholders had approved the merger on February 11. Under the terms of the consent decree entered into with the DOJ and an undertaking agreement with the EU, Alcoa was required to sell a 25% interest in Reynolds' Longview, WA, smelter, as well as Reynolds' interests in three alumina refineries—Worsley, Australia (56%); Stade, Germany (50%); and Sherwin, TX (100%). As a result of the merger, each outstanding share of Reynolds common stock was converted into 1.06 shares of Alcoa common stock (Alcoa Inc., 2000a).

On June 1, Alcan Aluminium Ltd. and algroup, the aluminum division of Alusuisse Lonza Group Inc., announced that, following the approval of the DOJ and the EU, the companies had reached agreement on their merger plan (Alcan Aluminium Ltd., 2000a). The EU gave its approval subject to commitments made by the companies to alleviate the EU's competition concerns in the aluminium trihydrate (ATH) market. Among its commitments, Alcan proposed selling algroup's ATH facility in Martinswerk, Germany, and the algroup lithography operations in Bridgenorth, United Kingdom (Platt's Metals Week, 2000a). The merger, which involved the combination of a cash payment and the exchange of 17.1 Alcan common shares for every algroup share, was finalized on October 17 (Alcan Aluminium Ltd., 2000b).

Bauxite.—For many years, domestic mines have supplied less than 1% of the U.S. requirement for bauxite. Essentially all the domestic bauxite production is used in nonmetallurgical products, such as abrasives, chemicals, proppants, and refractories. Thus, the United States imports almost all the bauxite, especially the metallurgical grade, that it requires.

Alumina.—Alcoa sold its 1.6-million-metric-ton-per-year (Mt/yr) Sherwin alumina refinery located near Corpus Christi, TX, to BPU Reynolds, Inc., a private investment company. The sale of the former Reynolds facility was required under the DOJ regulatory approval that cleared Alcoa's acquisition of Reynolds (Alcoa Inc., 2000b). According to the Corpus Christi Caller Times, the name BPU Reynolds derives from its four principal investors: former Reynolds Metals vice chairman Randy Reynolds; Peter Bailey, a former Alcoa executive who managed Alcoa's Point Comfort alumina refinery and its alumina chemical sales; retired Alcoa sales executive Lewis Paterson; and Mark Uzelac, a former Westinghouse executive (Metal Bulletin, 2000b).

In July 1999, Kaiser Aluminum & Chemical Corp.'s 1.05-Mt/yr Gramercy, LA, alumina refinery was extensively damaged by an explosion in the digestion area of the plant. Repairs on the damaged part of the plant began during the first quarter of 2000. Initial production at the plant commenced during the middle of December 2000, and production was expected to increase progressively throughout 2001. At the end of February 2001, the plant was operating at 70% of its newly rated capacity of 1.25 Mt/yr. Construction at the facility was expected to be completed during the third quarter of 2001 (Kaiser Aluminum & Chemical Corp., 2001, p. 16).

Alcoa announced the temporary closure of its 600,000-metric-ton-per-year (t/yr) alumina refinery at St. Croix, U.S. Virgin Islands. The plant, which had been operating since December 1997 and sold alumina to Alcoa-operated smelters in the United States, ceased production at the end of January 2001 (Alcoa Inc., 2000d).

Consumption

Bauxite.—Total domestic consumption of bauxite decreased by about 9% compared with that of 1999. Most of the decrease in consumption was accounted for by the continued loss of alumina production at the damaged Gramercy refinery. In 2000, 95% of the bauxite consumed in the United States was refined to alumina (an estimated 2.1 t of dried bauxite was required to produce 1 t of alumina); the remaining 5% was consumed in nonmetallurgical applications (table 4). Domestic production and consumption data for bauxite and alumina were obtained by the U.S. Geological Survey from three separate, voluntary surveys of U.S. operations. Typical of these surveys is "Bauxite Consumption," sent to 47 operations, 34 of which responded, representing 75% of total bauxite consumption listed in table 4.

C-E Minerals Inc. purchased North American Processing Co., which was renamed C-E Minerals Processing. The 68,000-t/yr plant in Newell, WV, processes refractory minerals such as bauxite, brown fused alumina, magnesite, magnesia, and silicon carbide (Industrial Minerals, 2000a).

Resco Products Inc. entered the refractory brick market following the purchase of certain divested assets from RHI Refractories America Inc. Resco acquired the former Harbison-Walker Refractories Co. plants in Hammond, IN, and Marelan, Quebec, as well as a number of product lines from the RHI plant in Farber, MO, and the former Harbison-Walker facility in Windham, OH. The divestitures were required for U.S. Federal Trade Commission (FTC) approval of RHI's acquisition of Global Industrial Technologies, Inc., in 1999 (The Refractories Institute, 2000).

Having made the required FTC divestitures, RHI began restructuring its North American operations. In April, a $10 million capital improvement program, which included the addition of three new hydraulic brick presses, related support equipment, and a minor plant expansion, was begun at the Windham, OH, facility. Plants in Curwensville and Wolmelsdorf, PA; Farber, MO; and Northeast, MD, were closed (Industrial Minerals, 2000c).

Alumina.—An estimated 90% of the alumina shipped by U.S. alumina plants went to domestic primary aluminum smelters for metal production. In 2000, 23 primary aluminum smelters consumed 7.16 Mt of alumina. Consumption in various forms by the abrasives, chemicals, refractories, and specialties industries accounted for the remainder of U.S. alumina use.

Prices

Most metallurgical-grade bauxite and alumina are purchased under long-term contracts. Contract terms for these commodities normally are not made public. Spot prices for metallurgical-grade alumina and specialty forms of bauxite and alumina for nonmetallurgical applications, however, are published in trade journals.

Industrial Minerals (2000b) quoted end-of-year prices for several types of imported refractory-grade bauxite from China and Guyana. The price quotes for Chinese refractory-grade bauxite, minimum 87% Al_2O_3 free on board (f.o.b.) Chinese ports, were as follows: Shanxi, shaft, lump, $71 to $75 per ton; Shanxi rotary, lump, $85 to $90 per ton; and Guizhou, round, lump, $70 to $73 per ton. The price ranges for Guyanese refractory-grade bauxite were as follows: $155 to $175 per ton, f.o.b. barge, U.S. Gulf Coast; and $165 to $175 per ton, cost, insurance, and freight (c.i.f.) Europe.

The 2000 annual average values of U.S. imports of metallurgical-grade bauxite are listed in table 7.

The market or spot prices for alumina continued to increase during the first four months of 2000, a trend that began in April 1999, then fell dramatically through December 2000. According to Metal Bulletin, metallurgical-grade alumina spot prices on international markets began 2000 at $375 to $385 per ton. The price range increased to $420 to $440 per ton in mid-February and held steady at this range through mid-May before beginning a precipitous decline through the end of the year. By yearend, the price range had decreased to $165 to $175 per ton. Trade data released by the U.S. Census Bureau indicated that the average annual value of U.S. imports of calcined alumina was $226 per ton, free alongside ship (f.a.s.) port of shipment, and $238 per ton, c.i.f. U.S. ports.

Trade

In addition to the trade data listed in tables 8-10, various specialty aluminum compounds were also exported from and imported to the United States. The compounds exported included 7,690 t of aluminum sulfate, 19,600 t of aluminum chloride, 9,020 t of aluminum oxide abrasives, and 5,550 t of various fluoride-based compounds of aluminum, including synthetic cryolite and aluminum fluoride. The compounds imported included 23,500 t of aluminum sulfate, 1,700 t of aluminum chloride, 120,000 t of aluminum oxide abrasives, and 21,500 t of various fluoride-based aluminum compounds.

World Review

In 2000, world production of bauxite increased 6% compared with that of 1999 (table 11). Mine production was reported in 22 countries, and total world production amounted to more than 135 Mt. The largest producers of bauxite, in decreasing order of tonnage mined, continued to be Australia, Guinea, Brazil, and Jamaica, accounting for about 70% of total world production.

World output of alumina increased 5% in 2000 compared with that of 1999 (table 12). The four principal producing countries, in order of quantity of alumina produced, were Australia, the United States, China, and Jamaica. These countries accounted for almost 60% of the world's production; Australia alone accounted for about one-third.

Australia.—Comalco Ltd. selected Gladstone in Queensland as the site for its proposed new $850 million ($1.4 billion Australian) alumina refinery. The company will conduct a final feasibility study to evaluate the project's long-term viability including commercial, technical, and environmental aspects (Comalco Ltd., 2000).

Comalco and its partners in Queensland Alumina Ltd. [Comalco (30.3%), Kaiser (28.3%), Alcan (21.4%), and Pechiney (20%)] also were examining prospects for an expansion of their existing Gladstone refinery, which is the

world's largest alumina refinery with 3.74-Mt/yr capacity. With the acquisition of the remaining publicly held shares (27.6%) of Comalco, Rio Tinto plc became the company's sole owner during the first half of 2000 (Rio Tinto plc, 2001, p. 39).

Alcan acquired the remaining 30% of the Gove alumina refinery and related bauxite mine making it the sole owner of these assets. Annual capacity of the Gove refinery, located in the Northern Territory, was 1.8 Mt (Alcan Aluminium Ltd., 2001a).

Worsley Alumina Pty Ltd. completed the $1 billion expansion of its alumina refinery south of Perth. The expansion, which included the construction of a $45 million gas-fired cogeneration plant to meet the refinery's higher steam and electricity requirements, increased alumina production capacity to 3.1 Mt from 1.22 Mt (Hagopian, 2000; Metal Bulletin, 2000l).

Alcoa and Billiton plc reached an agreement whereby Billiton would acquire Reynolds Australia Alumina, Ltd. LLC, which held a 56% interest in the Worsley alumina refinery, Western Australia, for $1.49 billion. Alcoa had acquired the stake in Worsley as part of its acquisition of Reynolds Metals, and was required to sell the Worsley interest as a condition of U.S. and European antitrust approval of the Reynolds Metals acquisition (Alcoa Inc., 2000c). The sale was completed in January 2001. As a result, Billiton increased its share of Worsley to 86% and the remaining 14% was owned by Kobe Steel Ltd., Nissho Iwai Corp., and Itochu Corp. (Alcoa Inc., 2001).

Azerbaijan.—The Government of Azerbaijan united three state-owned plants—the Sumgait aluminium smelter, the Gyandzha alumina plant, and Alunite Ore Mining Co.—into a single holding company, Azeraluminy JSC. The Government then invited tenders for a management contract for these plants (Metal Bulletin, 2000c). Fondel Metal Participants, a Dutch company, won a tender for the long-term management of Azeraluminy. Fondel reportedly agreed to invest $1 billion in the company and to modernize and expand production capacity at the 50,000-t/yr Sumgait smelter, the 450,000-t/yr Gyandzha refinery, and a bauxite mine (CRU Alumina Monitor, 2000).

Brazil.—Construction work on an 800,000-t/yr expansion has begun at the Alumina do Norte do Brazil S.A. (Alunorte) 1.5-Mt/yr alumina refinery. Brazil's National Development Bank would finance 70% of the cost, and the partners in Alunorte with the exception of the Japanese Consortium would finance the remainder. The remaining partners were Norsk Hydro ASA (25.25%), Mineração Rio do Norte (MRN) (12.62%), and Cia. Brasileira de Aluminio (CBA) (3.62%). Production was expected to begin at the end of 2002 and full production from the expansion would be available by mid-2003 (Mining Journal, 2000a).

The equity partners in MRN's Trombetas bauxite mine approved an expansion that would increase production by about 50% to 16.3 Mt/yr from 11 Mt/yr by 2003 (Alcan Aluminium Ltd., 2001b, p. 31). Alumina refinery expansions will require an increase in bauxite feed material, and this mine expansion should help to meet the increased demand. MRN's shareholders are Companhia Vale do Rio Doce (40%), Alcoa (13.12%), Billiton (12.5%), Alcan (12.5%), CBA (12.5%), Norsk Hydro (5%), and Abalco SA (4.37%) (Metal Bulletin, 2000d).

China.—Company officials reported that Pingguo Aluminium Co. had completed all of the financing and was awaiting final Government approval to start its phase 2 alumina expansion. The project would increase Pingguo's refinery production capacity to about 800,000 t/yr from 350,000 t/yr. The project was expected to take 3 years to complete, after which an additional expansion to 1.25 Mt/yr is planned (Platt's Metals Week, 2000b).

Guinea.—Russia's Sibirsky Aluminy (now part of Russky Aluminy) signed an agreement with the State Bauxite Co. of Guinea for a long-term supply of bauxite. Under the agreement, Guinea will supply bauxite to Sibirsky's alumina refineries in Russia and the Ukraine in exchange for mining equipment (Metal Bulletin, 2000k).

Hungary.—Magyar Aluminium Rt (MAL) integrated its 100%-owned affiliates (Ajkai Timfold Kft, owner of the 280,000-t/yr Ajka alumina refinery, and Inotai Aluminium Kft, owner of the 35,000-t/yr Inota aluminum smelter) into one holding company to reduce administrative costs and to simplify strategic planning (CRU Aluminium Monitor, 2000).

India.—Alcan sold its 54.6% stake in Indian Aluminium Co. Ltd. (Indal) to Hindalco Industries Ltd. Included in the sale was Alcan's share of production from Indal's 90,000-t/yr refinery at Muri and the 250,000-t/yr refinery at Belgaum (Metal Bulletin, 2000a).

National Aluminium Co. Ltd. (Nalco) completed the first phase of its alumina expansion program. Debottlenecking at its 800,000-t/yr Damanjodi refinery increased capacity to 1.05 Mt/yr of alumina. The company planned to further expand capacity to 1.575 Mt/yr in 2001. In addition, production capacity at Nalco's open pit bauxite mine on the Panchpatmali hills of the Koraput District in Orissa was doubled to 4.8 Mt/yr from 2.4 Mt/yr (National Aluminium Co. Ltd., Operations, accessed August 3, 2001, at URL http://nalcoindia.com/invdefault.htm).

Kazakhstan.—Kazakhstan Mineral Resources Group announced plans to increase production capacity at its 1.2 Mt/yr Pavlodar alumina refinery to 1.5 Mt/yr by 2005. The company expected to steadily increase the annual production levels by technological upgrades and the installation of new equipment without changing the existing process (Metal Bulletin, 2000e).

Romania.—Russky Aluminy (Russian Aluminium), which took control of operations at the Oradea refinery, restarted the plant using imported Australian bauxite. Russian Aluminium expected to continue to increase production during 2001 and to reach production capacity of 250,000 t/yr in 2002. In later years, annual capacity at the refinery may be increased to 300,000 to 350,000 t/yr (Metal Bulletin, 2000h).

Russia.—A new aluminum company, Russky Aluminy (Russian Aluminium), was formed by combining the assets of the Sibneft shareholder group and Siberian Aluminium. Russian Aluminium manages about 70% of Russia's primary aluminum smelting capacity. The company controls Russia's three largest smelters—Bratsk (900,000 t/yr), Krasnoyarsk (800,000 t/yr), and Sayansk (400,000 t/yr). As for alumina production, the company controls the Achinsk (900,000 t/yr) and the Nikolayev (1.05 Mt/yr) refineries. The downstream operations that are either fully or partly owned by the company include the Samara Metallurgical Plant, the Sayanal foil mill, the Rostar can plant, and the Belaya Kalitva Metallurgical

Production Assn. (Metal Bulletin, 2000j).

A second new group, SUAL Holding, resulted from a merger of the aluminum assets of Siberian-Urals Aluminium Co. and the Trustconsult Group. SUAL controls the Irkutsk (262,000 t/yr), Bogoslovsk (162,000 t/yr), Uralsky (70,000 t/yr), and Kandalaksa (63,000 t/yr) primary aluminum smelters. The company also owns the Bogoslovsk (930,000 t/yr) and Uralsky (570,000 t/yr) refineries, the Northern and Southern Urals bauxite mines, and the Sredny-Timan bauxite deposits (CRU Alumina Monitor, 2000). Downstream facilities include the Kamensk-Uralsky Metallurgy Plant (rolling mill), the Mikhailovsky Nonferrous Metal Processing Plant (Mikhalum foil plant), and the Irkutsk and Kirinsky cable plants (Interfax Mining & Metals Report, 2000b).

SUAL announced plans to expand production at the Sredny-Timan deposit to 2.5 Mt/yr by 2005. An annual capacity of 6.5 Mt was planned by 2020. The mined bauxite provides raw material for the Uralsky refinery. The ore is moved by truck over an ice field during the winter, but a new rail track is under construction to provide year-round transport. The company reported that a new refinery could be built at the mine site to produce alumina for sale to other Russian producers in the future. Explored reserves at the deposit were estimated at 250 Mt (Interfax Mining & Metals Report, 2000c, d).

Russian Aluminum announced plans to invest about $6.5 million (193 million rubles) to increase production at the Achinsk alumina refinery to meet its engineered capacity of 900,000 t/yr. The first phase of the upgrade was used to buy new equipment for the plant's nepheline mines. Production in 1999 was estimated at 770,000 t. The company planned to reach full production levels in 2002 (Metal Bulletin, 2000i).

The 268,000-t/yr Pikalevo alumina refinery signed a new 5-year supply agreement with Apatit, a supplier of nepheline concentrates. Apatit resumed concentrate shipments and agreed to supply 90,000 t of concentrates per month over the life of the contract. The Pikalevo refinery supplies the Vogograd and Volklov smelters (Interfax Mining & Metals Report, 2000a).

Ukraine.—Ukrainian Aluminium Co., a subsidiary of Russian Aluminium, reported that contracts were signed for 1.6 Mt of bauxite from Brazil, Guyana, India, and Italy to supply the 1.05 Mt/yr Nikolayev alumina refinery. Additional supply contracts with Australia, Guinea, Sierra Leone, and Venezuela were also being negotiated (Metal Bulletin, 2000g).

Ukrainian Aluminium also submitted plans for expanding capacity at the Nikolayev refinery to 1.5 Mt/yr. The expansion reportedly would involve upgrading the existing facility, rather than requiring additional construction (Metal Bulletin, 2000f).

Venezuela.—Pechiney signed a contract to invest $260 million over 3 years in Bauxilum, Venezuela's state-owned bauxite and alumina producer. The upgrade program would increase capacity at the 1.7 Mt/yr alumina refinery to 2.1 Mt/yr. Pechiney would not have a direct interest in Bauxilum, but would receive its investment return in the form of the 400,000 t/yr of additional alumina production (Mining Journal, 2000b).

Outlook

Identified world bauxite reserves are sufficient to meet cumulative world demand well into the 21st century. Considering the probability of discovering additional bauxite deposits plus the added possibility of employing lower grade bauxite occurrences and various alternative sources of alumina, world resources of aluminum remain adequate to satisfy demand for the foreseeable future.

Weakness in the national economies of most areas of the world will restrict growth and possibly decrease demand for aluminum in 2001. Most forecasters, however, anticipate that this weakness will be short-lived and that demand will pick up in 2002 and thereafter. The automotive and construction industries will continue to be the major drivers for aluminum use. Overall, world demand is expected to grow, despite a possible drop in the growth rate for the next year or so as the world economies begin their recoveries.

As for aluminum metal production, energy costs and shortages continued to force companies to idle smelter capacity during the first half of 2001. Additional production from newly commissioned smelters and brownfield expansions should keep world metal supply and demand fairly balanced in 2001. However, the alumina market ended 2000 in an oversupply condition that continued during the first half of 2001. Despite increased exports of alumina by Western refiners to both the Chinese and Russian markets, this oversupply situation in the alumina market is likely to continue until aluminum metal demand and production increase.

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TABLE 1
SALIENT BAUXITE STATISTICS 1/

(Thousand metric tons)

	1996	1997	1998	1999	2000
United States:					
Production, crude ore (dry equivalent)	W	NA	NA	NA	NA
Value	W	NA	NA	NA	NA
Exports (as shipped):					
Crude and dried	92	64	83	115	133
Calcined	40	21	16	34	9
Imports for consumption (as shipped):					
Crude and dried	10,200	10,700	11,000	9,890	8,550
Calcined	352	369	393	299	310
Consumption (dry equivalent)	11,000	11,500	12,700	11,700	10,600
World, production	117,000	122,000	122,000	128,000 r/	135,000 e/

e/ Estimated. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.
1/ Data are rounded to no more than three significant digits.

TABLE 2
ESTIMATED PRODUCTION AND SHIPMENTS OF ALUMINA IN THE UNITED STATES 1/

(Thousand metric tons)

			Total	
Year	Calcined alumina	Other alumina 2/	As produced or shipped 3/	Calcined equivalent
Production:				
1998	5,100	820	5,920	5,650 r/
1999	4,620	780	5,400	5,140 r/
2000	4,310	691	5,000	4,780
Shipments:				
1998	5,080	822	5,910	5,640 r/
1999	4,600	780	5,380	5,130 r/
2000	4,300	691	4,990	4,770

r/ Revised.
1/ Data are rounded to no more than three significant digits.
2/ Trihydrate, activated, tabular, and other aluminas. Excludes calcium and sodium aluminates.
3/ Includes only the end product if one type of alumina was produced and used to make another type of alumina.

TABLE 3
CAPACITIES OF DOMESTIC ALUMINA PLANTS, AS OF DECEMBER 31, 2000 1/ 2/

(Thousand metric tons per year)

Company and plant	1999	2000
Alcoa Inc.:		
Point Comfort, TX	2,300	2,300
St. Croix, VI 3/	600	600
Total	2,900	2,900
BPU Reynolds, Inc., Corpus Christi, TX	1,600	1,600
Kaiser Aluminum & Chemical Corp., Gramercy, LA	(4/)	1,250 4/
Ormet Corp., Burnside, LA	600	600
Grand total	5,100	6,350

1/ Capacity may vary depending on the bauxite used.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.
3/ Temporarily shutdown.
4/ Damaged in an explosion, partial restart in December 2000.

TABLE 4
U.S. CONSUMPTION OF BAUXITE, BY INDUSTRY 1/

(Thousand metric tons, dry equivalent)

Industry	1999	2000
Abrasive	113	111
Alumina	11,100	10,100
Chemical	W	W
Refractory	251	160
Other 2/	229	225
Total	11,700	10,600

W Withheld to avoid disclosing company proprietary data; included with "Other.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes cement, municipal water works, oil, and steel and ferroalloys.

TABLE 5
STOCKS OF BAUXITE IN THE UNITED STATES, DECEMBER 31 1/ 2/

(Thousand metric tons, dry equivalent)

Sector	1999	2000
Producers, processors, consumers	1,440	1,300
Government	6,800	5,710
Total	8,250	7,000

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Domestic and foreign bauxite; crude, dried, calcined, activated, all grades.

TABLE 6
STOCKS OF ALUMINA IN THE UNITED STATES, DECEMBER 31 1/ 2/

(Thousand metric tons, calcined equivalent)

Sector	1999	2000
Producers	349	334
Primary aluminum plants	959 r/	950
Total	1,310 r/	1,290

r/ Revised.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Excludes consumers stocks other than those at primary aliminum plants.

TABLE 7
AVERAGE VALUE OF U.S. IMPORTS OF CRUDE AND DRIED BAUXITE 1

(Per metric ton)

	1999		2000	
Country	Port of shipment (f.a.s.)	Delivered to U.S. ports (c.i.f.)	Port of shipment (f.a.s.)	Delivered to U.S. ports (c.i.f.)
Australia	$12.11	$20.09	$13.50	$25.53
Brazil	24.32	31.15	23.51	29.82
Guinea	22.37	28.81	23.05	29.09
Guyana	24.58	35.66	26.01	36.80
Jamaica	17.05	23.93	19.53	24.97
Weighted average	21.56	28.67	23.09	29.94

1/ Computed from quantity and value data reported to U.S. Customs Service and compiled by the U.S. Census Bureau, Department of Commerce. Not adjusted for moisture content of bauxite or differences in methods used by importers to determine value of individual shipments.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF BAUXITE,
CRUDE AND DRIED, BY COUNTRY 1/

(Thousand metric tons)

Country	1999	2000
Imports: 2/		
Australia	59	108
Brazil	1,520	1,560
Guinea	4,060	3,350
Guyana	1,010	1,020
Jamaica 3/	2,800	2,120
Other	456	391
Total	9,890	8,550
Exports:		
Canada	99	128
Mexico	11	2
Other	5	3
Total	115	133

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes bauxite imported to the U.S. Virgin Islands from foreign countries.
3/ Dry equivalent of shipments to the United States.

NOTE: Total U.S. imports of crude and dried bauxite (including the U.S. Virgin Islands), as reported by the U.S. Census Bureau, were as follows: 1999--8,900,000 tons and 2000--6,800,000 tons.

Sources: U.S. Census Bureau and the Jamaica Bauxite Institute.

TABLE 9
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF CALCINED BAUXITE, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1999				2000			
	Refractory grade		Other grade		Refractory grade		Other grade	
Country	Quantity	Value 2/	Quantity	Value 2/	Quantity	Value 2/	Quantity	Value 2/
Imports:								
Australia	--	--	22	2,380	--	--	28	2,740
Brazil	33	5,110	1	117	9	934	11	1,070
China	75	5,810	94	7,110	117	9,440	82	6,200
Guyana	42	4,700	12	1,010	36	4,100	8	613
Other	17	1,550	2	162	20	1,460	(3/)	29
Total	167	17,200	132	10,800	181	15,900	129	10,700
Exports:								
Canada	2	514	5	434	1	237	4	363
Japan	17	3,480	--	--	--	--	--	--
Mexico	6	1,170	(3/)	96	1	208	(3/)	67
Other	1	307	1	570	1	327	1	596
Total	27	5,470	7	1,100	4	772	5	1,030

-- Zero.
1/ Data are rounded to no more three significant digits; may not add to totals shown.
2/ Value at foreign port of shipment as reported to U.S. Customs Service.
3/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 10
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF ALUMINA,
BY COUNTRY 1/

(Thousand metric tons, calcined equivalent, and thousand dollars)

Country	1999		2000	
	Quantity	Value 2/	Quantity	Value 2/
Imports:				
Australia	2,380	430,000	2,440	497,000
Brazil	44	18,900	126	30,000
Canada	92	58,800	100	60,600
France	11	19,000	14	19,900
Germany	64	71,600	65	78,000
India	135	21,300	131	26,300
Jamaica	357	60,600	276	55,100
Japan	7	12,900	13	15,200
Suriname	580	95,300	559	105,000
Trinidad and Tobago	31	4,990	--	--
Venezuela	56	18,700	10	4,290
Other	48	32,700	86	41,000
Total	3,810	845,000	3,820	933,000
Exports:				
Brazil	1	2,040	1	2,080
Canada	923	224,000	990	263,000
China	27	7,310	1	2,680
Finland	(3/)	318	(3/)	772
Mexico	189	46,400	42	28,400
Netherlands	5	5,140	4	5,840
Norway	(3/)	218	(3/)	108
Russia	(3/)	97	(3/)	76
Sweden	(3/)	897	1	1,090
Other	88	148,000	47	148,000
Total	1,230	435,000	1,090	452,000

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Value at foreign port of shipment as reported to the U.S. Customs Service.
3/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 11
BAUXITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1996	1997	1998	1999	2000
Albania e/	1	1	--	--	--
Australia	43,063	44,465	44,553	48,416	53,802
Bosnia and Herzegovina e/	75	75	75	75	75
Brazil	10,998	11,671	11,961	13,839 r/	14,000 e/
China e/	6,200	8,000	8,200	8,500	9,000
Ghana	473	519	443	355 r/	504
Greece	2,452	1,877	1,823	1,883	1,991
Guinea e/ 3/	15,600	16,400	15,000	15,000	15,000
Guyana 3/	2,475	2,467	2,267 r/	2,359 r/	2,404
Hungary	1,044	743	1,138 r/	935 r/	1,047
India	5,757	6,019	6,102	6,712 r/	7,366
Indonesia	842	809	1,056	1,116	1,200 e/
Iran e/	150	150	336 r/ 4/	912 r/ 4/	1,000
Jamaica 3/ 5/	11,863	11,987	12,646	11,688	11,127
Kazakhstan	3,140 e/	3,380 e/	3,437	3,607	3,727
Malaysia	219	279	160	224 r/	123
Mozambique	11	8	6	8 r/	8
Pakistan	4	5	5	11	9
Romania	175	127	162	--	--
Russia e/	3,300	3,350	3,450	3,750	4,200
Serbia and Montenegro	323	470	226	500	630
Suriname	3,695	3,877	3,890 r/	3,715 r/	3,610
Turkey 6/	545	369	458	208 r/	459
United States	W	NA	NA	NA	NA
Venezuela	4,834	4,967	4,826	4,166 r/	4,200 e/
Total	117,000	122,000	122,000	128,000 r/	135,000

e/ Estimated. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

1/ World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through July 25, 2001.

3/ Dry bauxite equivalent of crude ore.

4/ Reported figure.

5/ Bauxite processed for conversion to alumina in Jamaica plus kiln-dried ore prepared for export.

6/ Public-sector production only.

TABLE 12
ALUMINA: WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/

(Thousand metric tons)

Country	1996	1997	1998	1999	2000 e/
Australia	13,348	13,385	13,853	14,532	15,681 4/
Azerbaijan e/	5	10	(5/)	50 r/ 4/	200
Bosnia and Herzegovina e/	50	50	50	50	50
Brazil	2,752	3,088	3,322	3,515 r/	3,500
Canada	1,060	1,165	1,229	1,233	1,200
China e/	2,550	2,940	3,330	3,840	4,330 4/
France	440	454	450 e/	400 e/	400
Germany	755	738	600 r/ e/	583 r/	700
Greece e/	602 4/	602	600	600	600
Guinea e/	640	650 4/	480	500	550
Hungary	208	76	138	145 r/	150
India e/	1,780	1,860	1,890	1,900	2,000
Ireland	1,234	1,273	1,200 e/	1,200 e/	1,200
Italy	881	913	930	973	950
Jamaica	3,200	3,394	3,440	3,570	3,600
Japan 6/	337	368	359	335 r/	340
Kazakhstan	1,083	1,095	1,085	1,152	1,200
Romania	261	282	250	277	417 4/
Russia	2,105	2,400 e/	2,465	2,657	2,850
Serbia and Montenegro	186	160 e/	153	156	250
Slovakia e/	100	100	100	100	100
Slovenia	88	85	70 e/	70 e/	70
Spain 7/	1,095	1,110	1,100 e/	1,200 e/	1,200
Suriname e/	1,600	1,600	1,600	-- r/	-- 4/
Turkey	159	164	157	159 r/	155 4/
Ukraine	1,000 e/	1,080 e/	1,291	1,230	1,360 4/
United Kingdom	99	100 e/	96	90 r/	100
United States	4,700	5,090	5,650 r/	5,140 r/	4,780 4/
Venezuela	1,701	1,730	1,553	1,335	1,400
Total	44,000	46,000	47,400 r/	47,000 r/	49,300

e/ Estimated. r/ Revised. -- Zero.

1/ Figures represent calcined alumina or the total of calcined alumina plus the calcined equivalent of hydrate when available; exceptions, if known, are noted.

2/ World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ Table includes data available through July 25, 2001.

4/ Reported figure.

5/ Production sharply curtailed or ceased.

6/ Data presented are for alumina used principally for specialty applications. Information on aluminum hydrate for all uses is not adequate to formulate estimates of production levels.

7/ Hydrate.