MINING AND METALS SECTOR REPORT
NO. 25 - APRIL 1999

INDUSTRIAL OPERATIONS DIVISION 2 **Sector Department 3**

The Aluminum Industry – Recent Performance and Prospects

1 - Introduction

The production chain for aluminum starts with the extraction of the mineral bauxite, of which there are abundant deposits in Africa, South America, Australian and Western India. Using the Bayer process, bauxite passes through a washing system, and is then dissolved in caustic soda at high temperature and pressure. The resulting liquid is transferred to a precipitator from which alumina (aluminum oxide) is produced. Metallic aluminum is then produced using an electrolytic bath through which a continuous current is passed.

The metallic aluminum obtained from this process is resistant, free from corrosion, easy to recycle, very light and malleable, as well as being an excellent conductor of heat and electricity. The final product is presented in the form of ingots that are subsequently transformed into a variety of products that include slabs, coils, extruded products, wires and cables.

Refiners (smelters) that produce metallic aluminum are located in areas with an abundant supply of electricity, since this accounts for 40% of the production costs of the metal. There are around 120 large smelters around the world, with more than 100 small smelting plants in China. A typical smelter, with production capacity of 375,000 t/year, requires investments of some US$ 1.6 billion.

2 – The Aluminum Chain around the World

♦ **BAUXITE**

World Production of Bauxite – 1995-98

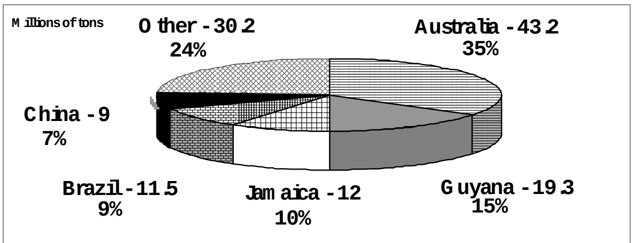
Million tons

Region	1995	1996	1997	1998[e]	%
Africa	18.3	19.0	19.9	19.9	15.9
North America	0.1	0.1	0.1	0.1	-
Latin America	31.7	33.9	34.9	34.3	27.4
Asia	14.8	16.2	16.3	16.9	13.5
Europe (Western & Eastern)	10.7	11.2	10.8	10.8	8.6
Oceania (Australia)	42.7	43.1	44.5	43.2	34.5
Total World	**118.2**	**123.5**	**126.5**	**125.2**	**100.0**

Source: World Metal Statistics Sep 98, IPAI & BNDES (estimate)

Australia is the largest producer of bauxite, followed by Guinea, Jamaica, Brazil and China. These producers account for a total production of 95 million tons, representing 76% of world production.

Largest Producers of Bauxite - 1998[e]



Source: World Metal Statistic (Sep 98) and BNDES (estimate).

♦ **ALUMINA**

World Production of Alumina – 1995-98

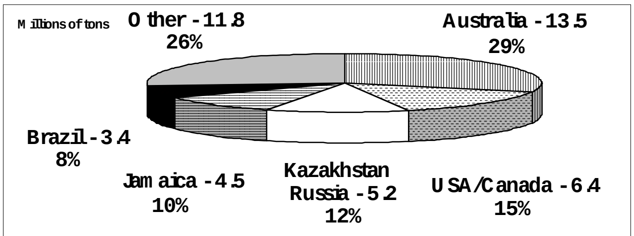
Million t

Region	1995	1996	1997	1998^e	%
Africa	0.5	0.5	0.5	0.5	1.1
North America	5.7	5.9	6.2	6.4	14.3
Latin America	8.5	9.3	10.0	10.4	23.2
Asia	3.6	3.7	3.8	3.9	8.7
Europe (Western & Eastern)	7.0	8.1	9.4	9.7	21.7
Oceania	13.2	13.3	13.5	13.9	31.0
Total World	**38.5**	**40.8**	**43.3**	**44.8**	**100.0**
Metallurgical Alumina	**34.5**	**36.8**	**39.3**	**40.5**	**-**

Source: World Metal Statistics (Sep 98), IPAI & BNDES (estimate)

As with bauxite, the world's largest producer of alumina is Australia, followed by the United States, Canada, Russia/Kazakhstan, Jamaica and Brazil. These producers account for total production of 33 million tons, representing 74% of world production.

Largest Producers of Alumina - 1998^e



Source: World Metal Statistic (Sep 98) and BNDES (estimate).

Estimates suggest that alumina production capacity could increase from 48.2 million tons in 1998 to 52.4 million tons at the end of 2001, with an increase of 4.2 million tons, or 8.7%. If this projection is realized then it will be necessary to expand bauxite production capacity by some 10 million tons.

Current and Projected World Alumina Production Capacity

Million t

	12/98	12/99	12/00	12/01	Incr. 98-01
Total World	**48.2**	**49.3**	**51.7**	**52.4**	**+ 4.2**

Source: World Metal Statistic (Sep 98), IPAI, BNDES.

Of the total projected increase of 4.2 million tons in alumina capacity, some 3.8 million tons will make possible an increase in aluminum production of more than 2 million tons, since 1.9 tons of alumina are required to produce 1 ton of metal.

♦ ALUMINUM

World Production of Primary Aluminum: 1995 –1Q99

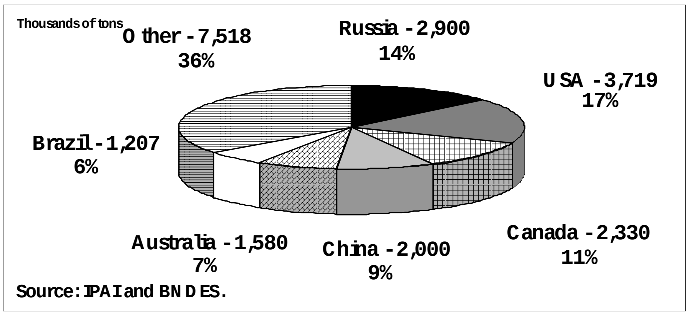
'000 t

Region	1995	1996	1997	1998	%	1Q99	Incr. %*
Africa	631	1,015	1,106	1,043	4.9	261	- 3.7
North America	5,546	5,860	5,930	6,086	28.6	1.515	+ 2.3
Latin America	2,058	2,107	2,116	2,075	9.8	507	- 1.5
Asia	4,246	3,969	3,185	3,148	14.8	762	- 3.1
Europe (W & E)	5,885	6,377	6,613	6,968	32.8	1.784	+ 5,4
Oceania	1,566	1,656	1,804	1,934	9.1	496	+ 6.2
Total World	**19,932**	**20,984**	**20,754**	**21,254**	**100,0**	**5,325**	**+ 2.5**
Growth %	**+ 4.0**	**+ 5.2**	**- 1.1**	**+ 2.4**	**-**	**-**	**-**

Source: IPAI, BNDES.
* % Growth relative to 1Q98.

The largest national producer of aluminum is the United States, followed by Russia, Canada, China, Australia and Brazil, whose aggregate 1998 production amounted to 13,736,000 tons, representing 65% of world production. The largest producers in the world by company (excluding Brazilian producers) are: Alcoa (1,701,000 t), Alcan (1,560,000 t), Pechiney (924,000 t), Reynolds (870,000 t), Norsk Hydro (663,000 t), Comalco (563,000 t), Kaiser (473,000 t), Alusuisse (270,000 t) and Hindalco (228,000 t), together accounting for around 45% of world production in 1998. Significant Brazilian producers include Albrás (345,000 t) and CBA-Companhia Brasileira de Alumínio (221,000 t).

Largest Producers of Aluminum - 1998



It should be emphasized that in 1998, aluminum production in Europe and Australia increased at rates well above the world average of 2.4%, achieving growth of 7.9% and 8.2% respectively.

1999 aluminum production is estimated at 21,650,000 tons, 1.9% higher than in 1998. For 2000 and 2001, growth rates could remain around this level, with production reaching some 22,480,000 tons in 2001. Over the period 1998-2001, production is expected to increase by 1,226,000 tons.

Projections point to an increase of around 1.8 million tons in world aluminum production capacity, of which some 800,000 tons should be added in China alone

Current and Projected Installed Primary Aluminum Capacity

'000 t

Region	12/98	12/99	12/00	12/01	Growth 98-01
Africa	1,262	1,278	1,388	1,401	+ 139
North America	6,533	6,562	6,755	6,902	+ 368
Latin America	2,139	2,197	2,208	2,309	+ 170
Asia	4,211	4,648	5,054	5,154	+ 943
Europe (W & E)	7,182	7,275	7,329	7,345	+ 163
Oceania	2,016	2,056	2,061	2,061	+ 45
Total World	**23,343**	**24,016**	**24,795**	**25,172**	**+ 1,828**

Source: World Metal Statistics (Sep 98), IPAI, BNDES.

It is possible that not all medium-term expansions will be realized, since current Western capacity is sufficient to satisfy projected demand for the period 1999-2000. The fall in demand from Asia, traditionally a major importer of the metal, reinforces this possibility, since the fall in consumption in the region led to the build-up of aluminum stocks during 1998.

Current aluminum production capacity in China is sufficient to meet domestic demand, although capacity expansions are expected over the next few years, in anticipation of future demand growth.

World Consumption of Primary Aluminum – 1995-98

'000 t

Region	1995	1996	1997	1998[e]	%
Africa	254	241	290	280	1.3
North America	5,667	5,968	6,032	6,430	29.4
Latin America	866	935	903	950	4.3
Asia	7,081	7,283	7,474	6,640	30.4
Europe (W & E)	6,240	5,915	6,632	7,230	33.1
Oceania	352	321	362	340	1.5
Total World	**20,498**	**20,702**	**21,730**	**21,870**	**100.0**
Growth %	**+ 3.9**	**+ 1.0**	**+ 4.9**	**+ 0.6**	**-**

Source: World Metal Statistics (Sep 98), BNDES (estimate).

Aluminum consumption is highly concentrated in North America, Europe and Asia. During the period 1995-98, growth averaged 4.3% per year, in North America and 5.0% in Europe. In Asia, growth was positive during 1995-97, averaging some 2.7% per year, but fell by 11.2% in 1998.

Over the period 1995-98, global consumption of aluminum grew by an average rate of 2.2% per year, falling to 0.6% last year, compared to an average rate of increase in production of 2.4%. Very moderate growth in world aluminum demand is projected for 1999, with growth rates likely to return to the 2-3% range from 2000 onwards.

The excess supply impacted negatively on metal prices, which fell from an average of US$ 1,620/t in 1997 to US$ 1,380 in 1998. The downward trend is expected to continue in 1999, with prices averaging US$ 1,254/t, with a recovery starting from 2000 onwards, with prices returning to around US$ 1,430/t.

International trade, that in 1997 represented around 60% of world consumption, fell by around 10% in 1998, to some 12.0 million tons, affected by the reduction in Asian imports. The largest importers of aluminum are Japan (2.8 million tons), United States (2.6 million tons) and Germany (1.5 million tons). The largest exporters are Russia (2.0 million tons), Canada (1.8 million tons), Australia (1.2 million tons) and Norway (1.0 million tons). For 1999, volumes are expected to be close to 1998 levels, improving from 2000 onwards, in the wake of a gradual recovery in the Asian market, as well as increased demand from the United States and Europe.

3 – The Aluminum Chain in Brazil

♦ BAUXITE AND ALUMINA

Bauxite and Alumina in Brazil–1996-98

'000 t

	1996		1997		1998[e]	
Company	**Bauxite**	**Alumina**	**Bauxite**	**Alumina**	**Bauxite**	**Alumina**
Alcan	393.6	233.4	420.4	234.2	461.2	256.2
Alcoa	658.1	863.1	660.2	837.0	665.0	842.0
Alunorte	-	827.7	-	1,197.0	-	1,430.0
Billiton	-	397.1	-	380.6	-	381.3
CBA	1,012.0	437.7	1,216.0	439.2		439.2
MRN	8,738.7	-	8,918.0	-	10,101.0	-
Other	257.7	-	289.2	-	289.2	-
Production of Companies	**11,060.1**	**2,759.0**	**11,503.8**	**3,088.0**	**11,516.4**	**3,348.7**
Imports	**1.1**	**90.3**	**39.8**	**5.4**	**30.0**	**6.0**
Supply	**11,061.2**	**2,849.3**	**11,543.6**	**3,093.4**	**11,546.4**	**3,354.7**
Exports	**4,569.4**	**427.2**	**4,373.5**	**606.2**	**4,549.1**	**1,059.5**
Consumption	**6,838.4**	**2,422.7**	**7,309.8**	**2,397.7**	**6,997.3**	**2,295.2**

Source: Abal, Periodicals, BNDES (estimate).

Bauxite production is growing, due principally to expansion of capacity by MRN - Mineração Rio do Norte, most notably to supply Alunorte's alumina production. In 1998, MRN recorded a 5.8% increase in domestic and foreign sales, which amounted to 9,966,000 tons. Production of alumina increased significantly with the full operation of Alunorte. As a result, Brazil stopped importing this raw material for aluminum production, shifting from importer to exporter, with a beneficial effect on the sector's trade balance.

♦ **ALUMINUM**

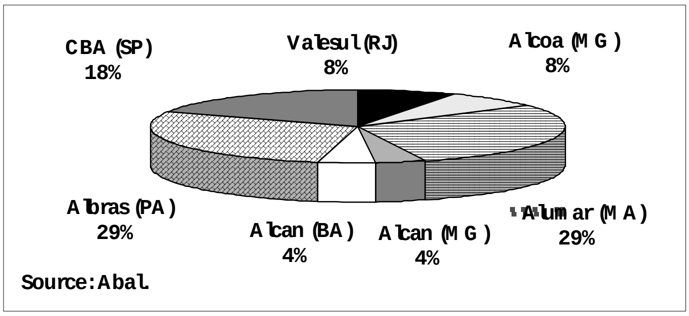
Primary Aluminum Market in Brazil – 1996-99

'000 t

Company	1996	1997	1998	1999[e]	% Incr. 99[e]/98
Albrás	339.7	338.0	344.7	355.9	+ 3.2
Alcan	93.4	93.3	102.5	102.5	-
Alcoa	283.4	279.7	281.4	285.8	+ 1.6
Aluvale	50.2	50.6	51.5	51.0	- 1.0
CBA	220.0	221.0	221.0	229.0	+ 3.6
Billiton	210.7	206.5	206.9	208.3	+ 0.7
Company Production	**1,197.4**	**1,189.1**	**1,208.0**	**1,232.5**	**+ 2.0**
+ Scrap	**145.6**	**162.0**	**176.0**	**173.0**	**- 1.7**
+ Imports	**83.7**	**142.9**	**164.9**	**127.4**	**- 22.7**
= Supply	**1,426.7**	**1,494.0**	**1,548.9**	**1,532.9**	**- 1.0**
Exports: Metal & Alloys	**709.0**	**716.2**	**692.4**	**716.1**	**+ 3.4**
Exports: Scrap & Semi-Finished Products	**96.9**	**100.5**	**84.0**	**79.1**	**- 5.8**
Adjustments [1]	**73.6**	**30.6**	**68.4**	**47.0**	**- 31.3**
Consumption	**547.2**	**646.7**	**704.1**	**690.7**	**- 1.9**

Source: Abal, Periodical, BNDES.
(e) Estimate by Abal.
(1) Estimate by BNDES.

Brazilian Production of Primary Aluminum - 1998



It is important to note that the production of the Alumar consortium is shared between Alcoa and Billiton, while the output of Valesul is divided between Aluvale and Billiton in proportion to their respective stakes in the company.

In 1Q99, aluminum production amounted to 303,400 tons, an increase of 4.3% with respect to the same period of 1998. Recent industry capacity stood at around 1,222,000 tons, although this could reach 1,262,000 tons this year, in the light of the productivity gains by Albrás and Alcoa, as well as increases in production by CBA. Projected production for the year is 1,232,500 tons, a 2.0% increase with respect to 1998.

Primary aluminum and alloy exports, which had been falling since 1996, began to grow again this year. In 1Q99, primary aluminum exports reached US$ 220 million, a reduction of 7.6% compared to the same period of last year. Export volumes rose 15.2%, although with a 19.7% reduction in the average market price.

In 1998, the average export price for aluminum metal was US$ 1,390/t, compared to US$ 1,604/t in 1997. Prices of semi-finished and finished products rose to US$ 4,260/t, against US$ 3,562.20/t in the preceding year.

In 1999, according to Abal, total exports of aluminum are expected to grow by 2.4% in volume terms to 795,200 tons, with a 3.4% increase in exports of primary aluminum and alloys, and a 5.8% reduction in exports of semi-finished products and scrap.

Abal also forecasts a reduction in imports in 1999, with a 22.7% fall in overall volumes to 127,400 tons. Semi-finished and manufactured products represent 92% of overall imports.

Domestic consumption of aluminum, after having risen significantly during 1997 and 1998, should fall by around 1.9% in 1999.

Aluminum Consumption – 1997-99

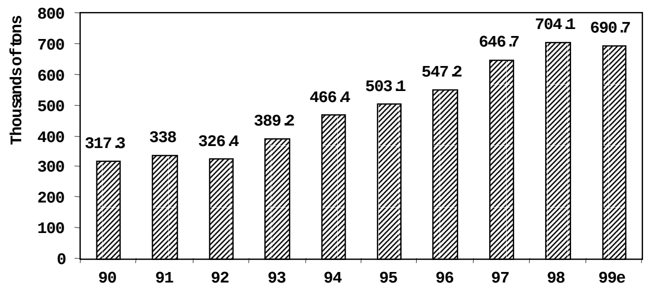
'000 t

Composition	1997	1998	1999^e	% Increase 99^e/98
Plates	256.9	277.6	278.6	+ 0.4
Simple Rolling	220.0	240.7	249.4	+ 3.6
Parts Rolling	30.4	30.8	25.7	- 16.6
Impacted Rolling	6.5	6.1	3.5	- 42.6
Sheets	46.0	53.7	56.8	+ 5.8
Extrusion	138.1	141.6	141.2	- 0.3
Wires/Cables	54.8	90.3	78.1	- 13.5
Foundry	91.4	82.6	85.7	+ 3.8
Powder	15.1	17.3	16.0	- 7.5
Destructive	31.2	30.7	29.0	- 5.5
Other	13.2	10.3	5.3	- 48.5
Domestic Consumption	**646.7**	**704.1**	**690.7**	**- 1.9**
Increase %	**+18.2**	**+8.9**	**-1.9**	**-**

Source: Abal (Brazilian Aluminum Market – Mar 99), (estimate).

Over the period 1990-98, domestic consumption of aluminum grew rapidly, at an annual average rate of 10.5%.

Domestic Consumption - 1990-99^e

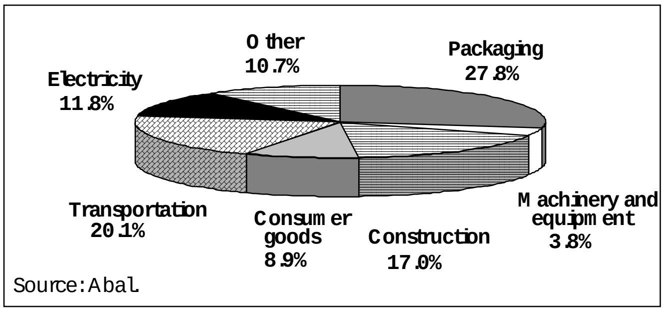


Source: Abal and estimates.

In 1998, domestic consumption grew by 8.9%, with this figure driven by growth in the wires and cables segment (+64.8%), the foil for packaging segment (+16.7%), and the pure rolling segment (+9.4%), which includes plates used in the production of cans for beer and soft drinks. For the current year, volume consumption of wires and cables is expected to fall by 13.5%, of foil to rise by 5.8%, and of plates to rise by only 3.6%, due to the reduction in investment in the electrical sector, and slower growth in the use of cans for beer and soft drinks. These three segments account for some 55% of domestic consumption. Consumption in the extruded products segment, that most notably includes aluminum frames, has stabilized around 141,000 t/year since 1996, with the same trend observed in the foundry segment, whose production of 85,000 tons/year is principally used to supply the automobile industry.

The sectors that consume the largest quantities of aluminum are packaging (27.8%) and transport (20.1%), followed by construction (17.0%).

Consumption by Sector – 1998



Various industry indicators for the last few years are presented below:

Principal Indicators

Indicators	1995	1996	1997	1998[e]
Direct jobs	57,912	53,140	50,801	N/A
Revenues (US$ billion)	5.5	6.0	6.6	6.5
Industrial GDP (%)	2.8	2.4	2.3	2.5
Per capita consumption kg/head/year	3.2	3.5	4.1	4.4
Trade balance (US$ billion FOB)	1.32	1.30	1.21	1.10
Electricity consumption (GWh)	18,189.5	18,297.3	18,115.6	18.361.6
Investments (US$ billion)	0.9	1.0	0.8	1.0

Source: Abal, BNDES (estimate).

Aluminum production is an energy intensive process. Electricity consumption of 18,361.6 GWh represented around 6.5% of national generation, indicating specific average consumption of 15.2 MWh/t. The average electricity tariff is around US$ 35.31/MWh for Group 1 customers, and around US$ 37.51 for Group 2 customers.

Recycling of cans within Brazil has been increasing from year to year, reaching 65% of all cans in 1998. It should be noted that recycling indices for the United States, Japan and Europe stood at 63%, 70% and 37% respectively.

In 1998, Brazil recycled 82,300 tons of aluminum from some 5.5 billion cans, representing around 46.8% of total recycling.

♦ TRENDS

At the international level, the aluminum sector is undergoing a restructuring phase, in a similar manner as other segments. The aluminum segment is dominated by around 10 large multinational groups (Alcan, Alcoa, Reynolds, Kaiser, Alumax, Pechiney, Norsk Hydro, Alusuisse, Alumix, and Comalco) with a presence in all parts of the world, as well as over a hundred local companies, such as Albrás in Brazil, and Venalum in Venezuela. The large groups are predominantly integrated and present at all stages from bauxite production to processed products for the final consumer.

With an excess supply of aluminum at international level due to sales in large volumes by Russia since 1993, prices have been in a continuous downtrend that has significantly impacted on the profitability of this business. As a result, the large groups have begun to make efforts to reduce costs and gradually shut down a portion of their production capacity. At the same time, they have adopted new business strategies, disposing of unattractive operations and investing in promising areas such as plastic packaging, energy and telecommunications.

An example is the sale by the Reynolds group of its can factories in the United States to Ball Corp., and more recently, of three rolling units in Europe to the integrated German producer, VAW. Alcoa also took control of a major energy group in the United States, with a view to reducing the costs of its own plants, as well as increasing its share in the distribution market.

Alcan is also in the process of concluding an agreement to supply aluminum directly in a large scale to the US automobile industry, on the basis of a price agreed by both parties. This new system departs from the current practice of taking LME prices as a basis, and once it is implemented, will allow better planning of the costs with a view to large-scale production of automobiles.

Recent headlines have indicated Pechiney’s intention of disposing of some of its can factories in Europe. There is also evidence that some groups that are traditional aluminum producers are focussing more on the automobile and transport sectors, at the expense of the beverage can sector, since the former are more attractive. Reynolds, Easco and Ornet are examples of these. Norsk Hydro plans to increase its share of the market and has been studying the purchase of smelters in Venezuela.

Within Brazil, Alcan has decided to invest in rolling mills, selling its two extrusion units to Alcoa, which as a result doubled its share of this segment to 50% of the domestic market. Alcoa has also decided to enter the telecommunications sector through an association with Alcatel that aims to capture 20% of this market.

The introduction of aluminum cans in the Brazilian beer and soft drink market attracted a number of multinationals such as Reynolds (Latasa), Pechiney (American Can), Crow Cork and Balls Metals. The segment has nevertheless failed to provide the desired returns, with Reynolds recently having chosen to sell its stake in Latasa. Its rivals took part in negotiations, but these failed to reach a successful conclusion, and Latasa remains under the control of Reynolds.

Given the size of the market by comparison with current installed capacity, it is also possible that the can segment will undergo a process of restructuring in order to adapt to future market conditions.

Technical Staff:

Maria Lúcia Amarante de Andrade – Manager

Luiz Maurício da Silva Cunha – Economist
Guilherme Tavares Gandra – Engineer
Eliane F. Costa de Oliveira – Intern

Editing: AO2/GESIS

Bibliography Assistant: Marlene C. Matta

Telephone: (55 21) 277-7184 / Fax: (55 21) 240-3504