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Santiago, Chile, 26 and 27 October 1989

# THE ALUMINIUM INDUSTRY OF LATIN AMERICA AND THE CARIBBEAN: TECHNOLOGICAL OPTIONS AND OPPORTUNITIES FOR GROWTH **/

*/ This meeting is being carried-out within the framework of ECLAC/UNCTAD/PNUD Project - RLA/87/019, "Assistance for Commercial Development and Trade Negotiations".

**/ A study by the Secretariats of ECLAC and UNCTAD, prepared for the meeting of "Technological Options and Opportunities for Development: The Aluminium and Tin Industries in Latin America and the Caribbean", as part of work programme RLA/87/019, "Assistance for Commercial Development and Trade Negotiations".

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Statistical Annex (cont'd)

## Introduction

(i) The present study has been prepared jointly by the ECLAC and UNCTAD secretariats using financial assistance by UNDP as part of a general project aimed at strengthening the external sector of Latin American and Caribbean economies (project RLA/87/019). The objective of the study is to identify options open to the governments and industries of Latin American and Caribbean countries with regard to the use of modern technology to improve the contribution of the bauxite/alumina/aluminium industry to economic development. A parallel study with the same objective has been prepared for tin.

(ii) While the use of modern technology to improve the situation of the aluminium industry is a matter of priority, it was found during the course of the work that developments in other areas merited attention. Consequently, the scope of the study is broader than implied by its title and recommendations are also made with regard to obstacles to trade, marketing, etc.

(iii) The parts of the study dealing with bauxite/alumina/aluminium production are based on a report by a consultant for ECLAC, Mr. Gilberto Costa Manso of the National Department of Mineral Production in Brasilia. Valuable assistance has also been given by a large number of persons in the Latin American/Caribbean and international aluminium industry who have provided information and advice.

(iv) The main findings of this study, as well as of the one on tin, are summarized in a shorter report comparing the situation of the two industries. All the reports are intended for presentation and discussion, with a view to finalize recommendations, at a meeting of experts at ECLAC headquarters in Santiago in October 1989.

Summary

(v) Chapter I of the present study is devoted to a review of supply of and demand for bauxite, alumina and aluminium since 1978, both at a global level and at the level of the Latin American/Caribbean region. It is noted that the world bauxite/alumina/aluminium industry has gone through a period of major restructuring during the last decade. Growth in consumption has been lower than in the 1960's or 1970's, mainly because of lower overall economic growth, changes in the composition of final demand and a slackening in the pace of substitution of aluminium for other materials. The use of scrap has increased relatively rapidly, resulting in a lower rate of growth for primary metal. Demand generally has increased fastest in developing countries.

(vi) The geographical distribtution of production has changed at all stages of production. The Caribbean countries have seen their share of world bauxite production fall, while those of Australia and Guinea have increased. Australia's production of alumina has also increased rapidly, as has that of continental Latin America, while production in Japan and the United States has fallen. As regards aluminium, energy resources have become the main factor determining location. Production has fallen in Japan and the United States. while it has increased in countries such as Australia, Brazil, Venezuela, Canada, Norway and the Gulf countries.

(vii) The production share of the six major producing companies has decreased at all stages of production, continuing a trend which was discernible already in the early 1970's. At the same time, the number and importance of independent, non-integrated producers, including state owned companies in developing countries, has increased, and as a result the industry has become more diverse. It should be noted, however, that the closures of high-cost capacity that have taken place have resulted in a flatter industry cost curve than before, reducing the difference in production costs between low-cost and high-cost producers.

(viii) Price instability has increased at the aluminium stage, partly as a result of the introduction of aluminium on commodity exchanges, partly because of the loss of some market control by major companies. Bauxite and alumina prices have generally remained more stable, but the increasing practice of linking alumina contract prices to prices for aluminium has had the effect of transferring a degree of price instability to alumina.

(ix) Aluminium consumption in the Latin American/Caribbean region, while increasing at a higher rate than world consumption, has been held back by the constraints imposed by the external debt situation. As a result, surplus capacity in the semi-manufactured products sector exists in Argentina, Mexico and Venezuela, while in Brazil the structure is more nearly balanced. Bauxite and alumina production has increased rapidly in Brazil and, lately, in Venezuela, while in the Caribbean countries production at these first two stages has stagnated or fallen as major producing companies have sought to diversify their supply or as a result of exhaustion of bauxite reserves. Aluminium production has increased by very large amounts in Brazil and Venezuela, as these two countries have taken advantage of their favourable natural resource endowments, in particular low-cost energy, and to a lesser extent in Argentina and Mexico.

(x) Latin American and Caribbean bauxite exports to areas outside the region have decreased over the last decade, with only Brazilian exports rising and other countries registering declines. Jamaica has to some extent compensated for the loss of North American markets by increasing exports to the USSR. Brazil, which in 1978 exported only very small quantities, has become a major exporter, in particular to the European market. Exports from Guyana and

Surinam have decreased overall, while exports from the Dominican Republic and Haiti ceased as bauxite production in these two countries was discontinued in 1982. In the Dominican Republic, however, production and exports started again in 1987, although with smaller volumes than before. Total alumina exports from the region also fell somewhat, although the pattern of trade remained largely unchanged, with most of the exports going to Western Europe and the balance mainly to North America. Unwrought aluminium exports increased by a factor of ten from 1978 to 1987, with Japan emerging as the most important trading partner. Brazil and Venezuela are by far the largest exporters. Finally, exports of semi-manufactured products, although still relatively small, increased rapidly, mainly as a result of Venezuelan exports to North America and Western Europe.

(xi) Intra-regional trade, although showing a high rate of increase, remains modest. Among the reasons for this may be the limited size of most national markets in the region, which make marketing efforts by individual efforts relatively costly; the existence of long standing contractual relationships with suppliers outside the region; transportation difficulties; time consuming foreign exchange and customs procedures; the existence of tariff and non-tariff barriers to trade; and, finally, the difficult financial situation facing most countries in the region, which has necessitated cut-backs in imports.

(xii) Chapter II deals with technology and costs of production in the bauxite/alumina/aluminium industry. Latin American and Caribbean bauxite producers are generally found to be competitive in terms of production costs, with Jamaica having the highest costs. Australia is the lowest cost producer, but this advantage is partly balanced by the costs of transportation for Australian bauxite to overseas refineries. As regards alumina, Latin American and Caribbean producers appear to have significantly lower costs than producers in North America or Europe. For primary aluminium, the situation is more mixed, with Argentina and Venezuela being very low cost producers, while production costs in Brazil, mainly because of higher energy costs, are more or less the same as in developed countries. It is noted that labour productivity, both in alumina refining and aluminium smelting, is generally lower in the Latin American/Caribbean area than in industrialized countries.

(xiii) In Chapter III, the expected development of demand and supply until the mid-1990's is discussed. Given relatively modest assumptions regarding the future rate of growth in demand, it is shown that the expected expansion of production would be compatible with a long run balance of supply and demand.

(xiv) It is expected that the trends already observed during the 1970's and 1980's, that is, location of alumina refineries close to bauxite mines and of aluminium smelters in areas where low-cost energy is available, will continue into the 1990's. Industrialized countries' share of production is expected to decrease at all stages and aluminium smelters in the United States and Western Europe are likely to be particularly sensitive to changes in prices or costs.

(xv) The Latin American/Caribbean region as a whole is expected to further confirm its status as a major exporter to the rest of the world at all stages of production, while aluminium consumption in the region itself would remain modest compared to capacity. However, given the large amount of unused capacity in the semi-manufactured products sector, the projection for primary aluminium consumption is uncertain. Nevertheless, even with rapidly growing regional consumption, the industry would remain essentially export oriented. The exportable surplus of primary aluminium is expected to be on the order of 1.8 million tons per year in the mid-1990's, or 65 per cent of expected production capacity. For alumina, the surplus could be about 3.5 million tons, or just under 40 per cent of capacity, while for bauxite the surplus would be almost 15 million tons, corresponding to about 40 per cent of capacity. Consequently, the industry will have to remain internationally competitive at all stages of production to ensure its continued survival and it will have a strong interest in the future development of the world market.

(xvi) Chapter IV deals with the opportunities for and constraints on increased Latin American and Caribbean production. As regards opportunities for exports to areas outside the region, Latin American and Caribbean exporters of bauxite are expected to see little change in their competitive position. For alumina, the market in Western Europe would appear to offer the best opportunities for increased Latin American/Caribbean exports, while for primary aluminium, Japan is expected to remain the most important market. Barriers to trade in the form of tariff and non-tariff measures are of relatively limited importance in industrialized countries, except in some cases for semi-manufactured products. Tariffs are, however, generally higher in developing countries, where a large portion of future consumption increase is expected to take place.

(xvii) It is noted that aluminium exporters in Latin America will have to consider their future marketing strategy carefully. Two basic kinds of strategy could be envisaged: either the Latin American exporters remain sellers of bulk products, in which case investments in marketing systems could remain small, sales could be handled through traders, and prices would be close to commodity exchange quotations; or they decide to diversify into more specialized products such as special alloys, which would necessitate the establishment of more ambitious marketing systems, but which would yield higher prices. If the second strategy were to be chosen, it would probably also imply greater efforts to penetrate major markets for semi-manufactured products. As regards opportunities for increased intra-regional trade, these largely depend on the extent to which the unrealized consumption potential which is thought to exist can be developed.

(xviii) Chapter V sets out conclusions and recommendations. It is noted that governments would probably prefer pursuing a diversified strategy with regard to this sector, a strategy focusing on increased intra-regional trade and a higher degree of downstream processing. Several favourable circumstances exist that would facilitate the implementation of this strategy. These include:

the existence of underutilized production capacity at different stages of production in several countries (bauxite and alumina in the Caribbean countries, semi-fabricated products in Argentina, Mexico and Venezuela);

competitive production costs, which make increased downstream processing a viable option;

low aluminium consumption relative to the level of economic development in most of the region's countries, which implies that markets can be further developed;

a high standard of technological know-how, implying that technological barriers may not be an insurmountable obstacle.

(xix) There are, however, several obstacles that would have to be overcome. One fundamental difficulty is obviously the shortage of investment capital and scarcity of foreign exchange created by the external debt situation of more countries in the region. The evolvement of this situation will set the conditions for any initiatives that can be taken by governments. Other obstacles may be more amenable to actions by governments and/or enterprises. These include:

the existence of barriers to trade in the form of tariffs and non-tariff measures taken by individual governments;

shortcomings of systems for payments, which tend to reduce the attractiveness of intra-regional trade;

insufficiency of export credit;

limited extent of market promotion activities;

insufficiently developed marketing systems and capabilities;

domestic price controls on ingot and processed products which at times create scarcity and bottlenecks and obstruct an efficient allocation of resources.

(xx) The following recommendations are made:

steps should be taken to reduce the incidence of tariff and non-tariff measures in intra-regional trade in semi-manufactured and manufactured aluminium products;

existing systems of payments should be reviewed with a view to facilitate trade in aluminium products between Latin American and Caribbean countries;

marketing systems and capabilities should be upgraded so as to allow increased exports, in particular of processed products, both within and outside the region;

co-operation between the producing companies of the region in the fields of research and development, market analysis, product development and promotion of aluminium consumption should be enhanced;

a number of possible joint venture prospects should be reviewed, including the construction of a caustic soda plant in the region, the construction of a plant producing petroleum coke and adaptation of presently unused capacity in the semi-fabricated products industry to market needs.

## I. DEVELOPMENT OF SUPPLY AND DEMAND SINCE 1978

### A. Global supply and demand and structural changes

1. By 1978, evidence of the restructuring of the world aluminium industry was already apparent. This restructuring took place partly in response to lower rates of consumption growth, and was stimulated by the emergence of new producers at each stage of the production process. As a result, the main producers, who had been able to dominate the market, lost a great part of their freedom of action. Their dominance was further limited by the successful introduction of an aluminium contract on the London Metal Exchange (LME) in 1978.

2. World consumption of primary aluminium increased at an average rate of 1.3per cent from 1978 to 1987 (or 1.4 per cent if socialist countries, for which consumption data may not be reliable, are excluded). This rate was drastically lower than the 8 to 10 per cent achieved in the earlier part of the post-war period. In 1988 consumption is estimated to have increased by about 3 per cent. Total aluminium consumption in non-socialist countries, including scrap, increased by an annual average of 2.2 per cent from 1978 to 1987, reflecting a rising trend in the recovery of scrap. Over the whole period, total aluminium consumption increased from 15.3 million tons in 1978 to 18.6 million tons in 1987. Table 1 shows consumption in 1978 and 1987 (see also tables A.1 and A.2 in the statistical annex)..

Table 1

Aluminium consumption in 1978 and 1987
(thousand metric tons)

| | 1978 | | | 1987 | | |
|---|---|---|---|---|---|---|
| | Primary | Secondary | Total | Primary | Secondary | Total |
| Developed market economy countries | 10647.3 | 3141.5 | 13788.8 | 11211.4 | 4595.2 | 15806.6 |
| North America | 5316.9 | 1592.8 | 6909.7 | 4957.6 | 2066.0 | 7023.6 |
| Western Europe | 3394.3 | 1096.8 | 4491.1 | 4049.7 | 1675.0 | 5724.7 |
| Japan | 1656.1 | 440.0 | 2096.1 | 1750.0 | 800.2 | 2550.2 |
| Oceania | 204.9 | 25.9 | 230.8 | 345.9 | 43.0 | 388.9 |
| Developing countriesa/ | 1391.7 | 146.3 | 1538.0 | 2485.8 | 290.9 | 2776.7 |
| Africa | 86.6 | 3.4 | 90.0 | 139.1 | 10.9 | 150.0 |
| America | 498.1 | 56.6 | 554.7 | 850.5 | 96.8 | 947.3 |
| Asia | 647.4 | 66.5 | 713.9 | 1324.6 | 147.4 | 1472.0 |
| Socialist countries of eastern Europe | 2725.0 | n.a | n.a | 2641.9 | n.a | n.a |
| Socialist countries of Asia | 590.0 | n.a | n.a | 862.0 | n.a | n.a |
| World | 15354.0 | n.a | n.a | 17201.1 | n.a | n.a |
| Non-socialist countries | 12039.0 | 3287.8 | 15326.8 | 13697.2 | 4886.1 | 18583.3 |

a/ Including Yugoslavia
Source: UNCTAD Secretariat

3. World economic growth rates from the late 1970's to late 1980's were lower than in the earlier part of the post-war period. In developed market economy countries, GDP increased at an average annual rate of 2.4 per cent from 1978 to 1986, as compared to 4.1 per cent from 1960 to 1980. Industrial production increased by 1.7 per cent annually from 1978 to 1986. In developing countries, GDP grew at an annual average rate of 2.6 per cent from 1978 to 1986 (5.6 per cent from 1960 to 1980), but growth in industrial production was slower, at 1.3 per cent annually.

4. In the case of most developing countries, particularly in the Latin American and Caribbean regions, economic growth rates fell during the first half of the 1980's as compared to the late 1970's. This fall in growth rates was mainly caused by falling prices of export goods, particularly commodities, the growing external debt, and the non-expansionary economic policies imposed by the external debt situation. As a result, expansion in industrial production was brought to a near halt, as shown by Table 2.

Table 2

Growth in total industrial production and in selected industries in Latin America and the Caribbean
(per cent average annual change)

| | 1975/80 | 1980/87 | 1978/87 |
|---|---|---|---|
| Industrial production | 5.6 | 1.9 | 2.9 |
| Mining | 4.6 | 0.4 | 1.3 |
| Metals | 4.3 | 2.8 | 3.1 |
| Coal | 6.5 | 6.2 | 5.9 |
| Petroleum and natural gas | 4.6 | 0.3 | 0.7 |
| Manufacturing | 5.9 | 1.9 | 2.9 |
| Electricity, gas and water | 9.3 | 5.8 | 6.5 |

Source: UNCTAD: Handbook of international trade and development statistics, 1988.

5. The reduced economic growth rates, in particular the lower growth of industrial production as the service sector has assumed a more important role in most developed economies, has obviously had a moderating influence on aluminium demand. Nevertheless, as seen from Table 1, aluminium consumption has continued to increase at a relatively high rate in developing countries. From 1978 to 1987, total aluminium consumption increased at an average annual rate of 8.4 per cent in Asia, 5.8 per cent in Africa and 6.1 per cent in Latin America and the Caribbean. This increase took place in spite of slow growth in overall industrial production, reflecting the difference in composition of industrial output in developing countries from that of developed countries. Aluminium consumption in developed market economy countries, which in the second half of the 1970's had still increased at an average annual rate of 7.1

per cent, or faster than industrial production, grew only at 1.9 per cent per year from 1980 to 1987, a pace just below that of industrial production. In developing countries, the rate of increase in aluminium consumption was 9.2 per cent per year from 1975 to 1980 and 7.1 per cent from 1980 to 1987, in both periods clearly higher than the rate of growth in industrial production.

6. Yet another factor contributing to the slowing down of the growth in aluminium demand is the slackening in the pace of substitution of aluminium for other materials, which earlier accounted for a major part of the fast increase in aluminium consumption. The only major new market for aluminium to appear in the last decade is that of beverage cans, where aluminium has replaced tinplate in several countries and where its market share is likely to increase further. In most other end uses, aluminium has only been able to keep its market share or, in some cases, to increase it marginally. Technical change, including the development of better alloys and design changes allowing less aluminium to be used in a given product, has also limited growth. Table3 shows aluminium consumption in different end uses in Japan, Western Europe and the United States in 1978 and 1987. The table illustrates that the packaging sector has been the most dynamic sector of the market.

Table 3

Consumption of aluminium (primary and secondary) according to end uses in Japan, Western Europe a/ and the United States in 1978 and 1987
(per cent of total consumption) b/

| | Japan | | Western Europe | | United States | |
|---|---|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 |
| Transport | 23.1 | 29.2 | 27.8 | 29.9 | 23.1 | 20.7 |
| Mechanical engineering | 4.5 | 4.3 | 6.6 | 7.7 | 6.0 | 5.9 |
| Electrical engineering | 10.5 | 8.3 | 10.7 | 9.0 | 10.4 | 9.2 |
| Building and construction | 34.3 | 28.6 | 17.6 | 19.7 | 23.0 | 21.0 |
| Chemical industries and agricultural uses | 1.8 | 0.3e | 1.7 | 1.2 | 1.4 | -d |
| Packaging | 6.8 | 7.8 | 10.6 | 11.3 | 23.0 | 30.1 |
| Household articles | 6.2 | 1.5c | 9.0 | 6.1 | 7.4 | 8.4 |
| Powder consuming industries | 0.4 | 0.3c | 0.7 | 0.5 | -d | -d |
| Iron and steel industriese | 2.8 | 3.3 | 4.7 | 5.1 | -d | -d |
| Miscellaneousf | 9.7 | 16.3 | 10.5 | 9.6 | 5.6 | 3.8 |
| Statistical adjustment | - | - | - | - | - | 0.8 |

a/ Austria, Belgium-Luxemburg, Federal Republic of Germany, France, Italy, Norway, Spain, Switzerland and the United Kingdom.

b/ Since consumption of imported semi-manufactures is not included, consumption in some sectors, notably those using rolled products, such as packaging, may be understated, particularly in Western Europe. This factor is probably of less importance in the case of Japan and the United States.

c/ Data incomplete

d/ Included in miscellaneous

e/ Includes "metal products" for the following countries in Western Europe: Austria, Belgium-Luxembourg and France.

f/ Includes "metal products" for Japan and for the the following countries in Western Europe: Federal Republic of Germany, United Kingdom. Although not stated explicitly in the source, the same is the case for Italy, Norway, Spain and Switzerland.

Source: Metal Statistics, Metallgesellschaft, Frankfurt a. m.

7. A factor which has assumed increased importance in the last decade is recycling of aluminium. On a global scale, the use of secondary aluminium increased from 21.5 per cent of total consumption in 1975 to just over 26 per cent of consumption in 1987. The increase in scrap use is partly accounted for by the fall in the rate of increase of aluminium consumption, since the supply of scrap is a function of earlier metal consumption. The growth of aluminium use in beverage cans, which are typically recycled at a rate of between 50 and 80 per cent, has also contributed to the increase in scrap use, in particular since the life of a beverage can is short compared to that of most other aluminium containing products.

8. As can be seen from Table 1, the proportion of scrap use to total consumption of aluminium varies considerably between regions. It is generally lower in the developing world than in developed countries, the reasons for this being the faster growth of overall consumption in developing countries and differences in composition of consumption, with a proportionately higher share of consumption in developing countries being accounted for by products with a long life.

9. As a result of the fall in the rate of increase of demand, the growth strategy of the aluminium producers, which was based on low profit margins and high rates of growth on sales has had to be adapted to a stagnant market. The profit margins had to be higher to retain the desired level of revenues and that was possible only through higher added value or to a lesser extent, through higher mark-ups over unit costs of production1/.

10. The first path was the one chosen by major producers who sought, not only an increase in the degree of processing, but also started new fields of operation, both through development of new aluminium products (eg. Kaiser) and development of advanced materials in general (eg. Alcoa).

11. The second factor which contributed to the restructuring of the industry, apart from the slowing down of demand growth rates, was the attempt of Third World countries to look for better returns from their mineral resources, through increases in the price of exported raw materials, through the involvement of governments as producers, through pressure on the traditional producers for a higher degree of processing of mineral production, or finally, through new taxation systems.

12. Thirdly, the global economic crisis of the 1970's and the 1973 oil shock with subsequent high inflation, played an important role in the process of decentralization of the industry, towards lower cost and energy rich regions.

13. As a result of the restructuring process, the share of primary smelting capacity in non-socialist countries held by the six major producers2/, which was above 70 per cent during the 1960's and early 1970's, was reduced to 52 per cent in 1978, and fell further to 45 per cent in 1987. For bauxite their share fell from 43 per cent in 1978 to 37 per cent in 1987, and for alumina, it was reduced from 61 to 59 per cent during the same period 3/. Although ownership and control is not exactly synonymous, the six majors have, in fact, lost part of their control over the industry. It should also be noted that the number of producers is very large at the semi-fabricating stage, although the major companies hold a strong position in some sectors as a result of their greater technological know-how.

14. One particularly important class of new-comers during the 1970's and 1980's were the state companies of Third World countries, especially those with abundant natural resources. In fact, the contribution of developing countries to the world metal production has shown a steady increase, thus partially compensating for the closures in the United States and Japan (see table 4 and table A.5 in the statistical annex).

15. The Japanese case is an extreme example of adjustment to the new situation. From a peak metal production of over one million tons in the 1970's, it poured only 41,000 tons of primary metal in 1987.

16. The United States has also contributed with significant reductions in smelting capacity totalling about 600,000 tons from 1975 to 1988, thereby bringing the United States share of world primary capacity (excluding socialist countries) down from 37 to 28 per cent. It is still, however, the world's largest producer. At the same time, its industry has undergone structural changes with several smelters changing ownership and some becoming independent producers.

17. Countries which have emerged as important metal producers during the period 1978 to 1987 include Australia and Brazil, the two countries showing the highest rate of growth, and Venezuela, which although up to 1987 still a medium size producer, has plans to become one of the largest in the years ahead.

Table 4

World primary aluminium production
(thousand metric tons)

| | 1987 | 1983 | 1987 |
|---|---|---|---|
| Developing market economy countries | 10 306.4 | 8 886.5 | 9 825.5 |
| North America | 5 406.4 | 4 444.4 | 4 883.4 |
| Western Europe | 3 346.7 | 3 327.2 | 3 454.7 |
| Japan | 1 057.7 | 255.9 | 40.6 |
| Oceania | 414.5 | 695.2 | 1 276.2 |
| Developing countries a/ | 1 305.8 | 2 188.6 | 3 106.8 |
| Africa | 255.2 | 260.1 | 401.0 |
| America | 419.6 | 945.6 | 1 500.3 |
| Asia | 454.2 | 724.7 | 911.6 |
| Socialist countries of Eastern Europe | 2 786.4 | 2.836.9 | 2 844.4 |
| Socialist countries of Asia | 370.0 | 435.0 | 550.0 |
| TOTAL | 14 768.6 | 14 347.0 | 16.326.7 |

a/ Including Yugoslavia
Source: UNCTAD secretariat

18. The key input now is low cost energy. As a general rule this should favour the energy rich developing countries whose energy resources have a lower opportunity cost compared with the industrialized countries. But some of the countries with abundant energy supply in the latter group have been able to maintain and even increase their production, as for example, Canada and Norway. It should be noted that several producing companies have succeeded in obtaining electricity supply contracts in which the price of electricity is linked to the aluminium price, thus reducing the incidence of electricity costs on profits.

19. During the period of restructuring, the main operative factor as far as the smelter stage of the industry is concerned has probably been production costs, in particular energy costs. It is argued, however, that in the future the maturity of the industry will be a more important determinant of structure and of strategy, in particular since this will require producers to pay increased attention to the quality dimension.

20. With regard to bauxite, the desire of the developing countries to increase their share of the revenues of the industry emerges as an important driving force behind the changes in the geography of supply during the period. In fact the state has had an important role (although not exclusive) in establishing new mine capacity in countries such as Brazil, Guinea and Venezuela, either through direct involvement or through subsidies.

21. Another major change which has taken place is the reduction of the share of the Caribbean countries in world bauxite and alumina production. Here it is possible to identify two concurrent factors operating in the same direction. First the effect of the imposition of bauxite levies by those countries which chose this route to achieve a higher participation in the revenues generated by the industry. Second - and possibly more important according to some analysts4/ - the producing companies' strategy and choice of diversifying the sources of raw materials to countries which seemed to offer one or a combination of the following factors: lower production costs, greater political stability, or better suitability to the company global strategy.

22. As a result, the Caribbean countries almost halved their share in non-socialist world bauxite output during the 1978-1987 period from 32 per cent to 17 per cent. One of the major beneficiaries of this supply relocation, besides Brazil, has been Australia, now the leading producing country, whose share in Western world production rose from 32 per cent in 1978 to an impressive 40 per cent in 1987, and Guinea (see Table 5 and Table A.3 in the statistical annex).

23. Concerning the supply of alumina it is interesting to note that at this stage the six majors have experienced a relatively smaller decrease in their share of capacity, or by about 2 per cent. In fact this is the stage of the industry which has showed the least change in the structure of supply. Although alumina refineries are not particularly energy intensive it is possible to list a number of economic reasons which would justify the relocation of these operations from the consuming to the bauxite producing countries 5/. While some relocation has taken place, the extent has been smaller than may have been expected in the light of these reasons. The establishment of aluminium refineries during the 1980s in Ireland and Spain, in particular, have gone against this trend.

24. In fact, the ratio of alumina to aluminium production in Western Europe increased from 1.25 in 1978 to 1.48 in 1987 (see tables 4 and 6 6/). In Japan, where the smelting capacity was almost extinguished during this period, a significant refinery capacity of just over 700.000 tons/year, most of it for non-metallurgical applications, is still maintained. The United States was the only major consuming country where the rate of alumina to aluminium production actually fell during the period, from 1.40 to 1.24.

Table 5
World bauxite production
(thousand metric tons gross weight)

| | 1978 | 1983 | 1987 |
|---|---|---|---|
| Developing market economy countries | 30 880.7 | 29 221.8 | 38 745.4 |
| North America | 1 918.9 | 780.8 | 662.4 |
| Western Europe | 4 668.8 | 4 068.0 | 3 877.0 |
| Oceania | 24 293.0 | 24 373.0 | 34 206.0 |
| Developing countries a/ | 45 216.1 | 40 364.4 | 47 140.0 |
| Africa | 13 783.9 | 13 864.0 | 17 899.0 |
| America | 25 131.8 | 19 435.4 | 21 701.0 |
| Asia | 3 734.4 | 3 565.0 | 4 146.0 |
| Socialist countries of Eastern Europe | 10 307.8 | 9.637.0 | 8 431.0 |
| Socialist countries of Asia | 1 400.0 | 2 100.0 | 2 750.0 |
| TOTAL | 87 804.6 | 81 323.2 | 97 066.4 |

a/ Including Yugoslavia
Source: UNCTAD secretariat

Table 6
World alumina production
(thousand metric tons actual weight)

| | 1978 | 1983 | 1987 |
|---|---|---|---|
| Developing market economy countries | 19 839.8 | 18 364.0 | 21 030.0 |
| North America | 7 183.6 | 5 336.0 | 5 102.0 |
| Western Europe | 4 167.2 | 4 419.0 | 5 108.0 |
| Japan | 1 767.2 | 1 378.0 | 711.0 |
| Oceania | 6 775.8 | 7 231.0 | 10 109.0 |
| Developing countries a/ | 5 817.2 | 6 361.0 | 8 127.0 |
| Africa | 621.6 | 564.0 | 542.0 |
| America | 4 085.6 | 4 250.0 | 5 728.0 |
| Asia | 613.0 | 537.0 | 745.0 |
| Socialist countries of Eastern Europe | 4 662.4 | 5.645.0 | 6 099.0 |
| Socialist countries of Asia | 700.0 | 900.0 | 1 215.0 |
| TOTAL | 15 536.7 | 15 635.0 | 18 235.5 |

a/ Including Yugoslavia
Source: UNCTAD secretariat

25. While the ratio of alumina to aluminimum production in Latin American and Caribbean countries fell from 9.74 to 3.82 during the same period, this was mainly due to the reduction of bauxite and alumina production for export in the Caribbean.

26. As regards international trade in bauxite/alumina/aluminium, two factors have influenced development since the late-1970's. The first is the geographical relocation of much of the industry and the other is the increased diversification of trade, which has resulted from the decreased degree of concentration in the industry.

27. World exports of bauxite increased from 34.5 million tons in 1978 to 38.6 million tons in 1980. In the following years, they fell to a low of 29.9 million tons in 1983 and have increased slowly since then to 33.2million tons in 1987 (see table A.6 in the statistical annex). Behind this development lies both a geographical shift in bauxite production from the Caribbean area to countries such as Australia, Brazil and Guinea, and a trend in many bauxite producing countries, including, in particular, Australia and Brazil, towards forward integration into alumina production. The proportion of total bauxite exports accounted for by developing countries increased from 74 per cent in 1978 to 80 per cent in 1987, mainly as a consequence of increased exports from Guinea and Brazil. In the Caribbean area, exports decreased in Jamaica, Surinam and Guyana, and stopped altogether in the Dominican Republic and Haiti, as mining there was discontinued (mining in the Dominican Republic started again in 1987). Exports from developed market economy countries fell from 24 per cent of total exports in 1978 to 17 per cent in 1987, mainly as a result of the increased processing of Australian bauxite into alumina, which reduced the amount of bauxite available for export. Main exporters of bauxite are, in order of importance, Guinea, Jamaica, Australia, Brazil, Guyana, Sierra Leone and Greece.

28. The share of imports of bauxite going to developed market economy countries decreased from 85 per cent in 1978 to 72 per cent in 1987, reflecting the reduced share of these countries in alumina production (see table A.7 in the annex). The share of developing countries, in contrast, increased from 1 to 9 per cent as a consequence mainly of markedly increased Venezuelan imports. The world's major importing countries for bauxite are the United States, the USSR, the Federal Republic of Germany and Canada.

29. World exports of alumina increased from 14 million tons in 1978 to over 17 million tons in 1987, or at an average annual rate of 2.6 per cent (see table A.8 in the annex). As in the case of bauxite, a peak was reached in 1980 and exports then fell until 1982/83 when growth resumed. Developing countries' share of total alumina exports dropped from 31 to 25 per cent during the period, as a consequence of reduced exports from Jamaica and Guyana, with increased exports from Yugoslavia, Venezuela and Surinam being sufficient to yield a very slight increase in absolute volume. The share of developed market economy countries increased from 64 to 71 per cent, with most of the increase being accounted for by Australian exports. Exports from Ireland and Italy also increased. The main alumina exporters in 1987 were Australia, accounting for almost half world exports, followed by Jamaica, Surinam, the United States, Ireland, Italy, Guinea, the Federal Republic of Germany, Venezuela and Yugoslavia.

30. The share of world imports of alumina accounted for by developed market economy countries fell by less than their share of bauxite imports, or from 79per cent in 1978 to 74 per cent in 1987 (see table A.9 in the annex). The share of developing countries increased from 10 to 17 per cent during the same period, reflecting the establishment or upgrading of aluminium smelters in countries with no alumina refinary capacity, such as Argentina, Bahrain, Egypt and Indonesia. The main world alumina importers are the United States, Canada, Norway, the USSR and the Federal Republic of Germany.

31. Total exports of unwrought aluminium increased almost continuously through the period, from 4.3 million tons in 1978 to 7.3 million tons in 1987, or by an annual average of 6 per cent, reflecting the fact that an increasing portion of aluminium is entering international trade (see table A.10 in the annex). This is partly a consequence of the relocation of aluminium smelters away from markets to sites with low electrical power costs, partly a result of the relatively stronger consumption growth in regions outside the traditional consuming areas. To some degree it also reflects the increased importance of independent non-integrated smelters with diversified markets. Exports from developing countries increased from 0.5 million tons in 1978 to 1.7 million tons in 1987, or at an average annual rate of 15 per cent, which raised their share of world exports from 11.4 per cent to 23.6 per cent. Brazil, Venezuela, Indonesia, the United Arab Emirates and Egypt accounted for most of the increase. Exports from developed market economy countries increased at an average annual rate of 4.4 per cent, but their share of world exports fell from 73 per cent in 1978 to 64 per cent in 1987. Exports increased in particular in Australia and Canada. The main aluminium exporting countries are Canada, Norway, Australia, the USSR, Brazil, the Federal Republic of Germany, the Netherlands, Venezuela, the United States and New Zealand.

32. As a consequence of the relocation of smelters mentioned in the preceding paragraph, the share of world imports of aluminium going to developed market economy countries increased from 72 per cent in 1978 to 73 per cent in 1987, following a more dramatic increase earlier in the 1970's, while that of developing countries fell slightly from almost 13 per cent to 11.6 per cent (see table A.11 in the annex). The main aluminium importing countries are Japan, the United States, the Federal Republic of Germany, France, Italy and Belgium/Luxembourg.

33. World exports of semi-manufactured aluminium products grew at an average annual rate of 6.7 per cent, from 2.0 million tons in 1978 to 3.6 million tons in 1987, reflecting the increasing diversification of the international aluminium market as well as a relative decrease in barriers to trade (see table A.12 in the annex). Exports from developing countries increased at an average annual rate of 17 per cent with Egypt, Venezuela, Bahrain and Brazil registering the largest increases. Developing countries accounted for 15 per cent of world exports in 1987, having increased from 6 per cent in 1978. Exports from socialist countries are 6 per cent of the total, and developed 6arket economy countries account for the balance, with the Federal Republic of Germany, France, Belgium/Luxembourg, the United States and Japan being the main exporters.

34. The share of world imports going to developed market economy countries has increased from 70 to 76 per cent, while that of developing countries has fallen from 20 to 17 per cent (see table A.13 in the annex).

35. World exports of scrap increased rapidly, at an annual rate of 12 per cent, from 1978 to 1987 (see table A.14 in the annex). Developing countries, essentially Hong Kong and Singapore, have accounted for about 5 per cent of exports throughout the period. The United States accounts for 25 to 30 per cent of world exports, with the rest shared among other developed market economy countries, mainly the Federal Republic of Germany, Canada, France and the Netherlands. Japan is the main importer (see table A.15 in the annex).

36. Tables A.16 to A.19 in the statistical annex show the structure of world trade in bauxite, alumina and aluminium in 1978 and 1987. One thing to be noted from these tables is the small size of intra-regional Latin American/Caribbean trade compared to total exports from the region.

37. Aluminium prices throughout the period studied have been more volatile than earlier. In particular, short-term price movements have increased. This change is generally attributed to the introduction of aluminium at the London Metal Exchange (LME) in 1978 and the growing influence that the LME quotation has exercised over contract prices ever since. It is likely, however, that the diminished ability of the major producers to set prices independently and preserve some price stability is also due to their shrinking share of world production. Since 1978, the aluminium price has gone through three cycles, with peaks recurring in early 1980, mid-1983 and June 1988. Since the last peak, prices have fallen considerably, although they are still (in June 1989) at a level which fully covers the production cost of virtually every smelter now in production (see table A.20 in the annex).

38. Bauxite and alumina are generally traded under long-term contracts, with prices moving only slowly. However, since early 1988 an acute shortage of alumina has pushed prices up, in particular on the very small spot market, although prices in long-term contracts have also been affected. Bauxite prices have generally not been subject to the same increases. An increasing tendency to link prices in long-term contracts for the supply of alumina, and, to a smaller extent, of bauxite, to the aluminium price has transferred to some degree the volatility of this price to alumina and bauxite.

## B. Supply and demand in Latin America and the Caribbean - an analysis by country and company

39. The Latin American and Caribbean region has been a source of bauxite to the aluminium industry since the 1920's. Until the mid 1960's Jamaica, Suriname and Guyana were the three largest producers in the Western World. Australia - at present by far the largest supplier - first appeared as an important producer in the 1960's to become the first in 1971. The other producers in Latin America and the Caribbean up to the early 1970's included Brazil, the Dominican Republic and Haiti. By 1983, however, mining had been discontinued in both Haiti and Dominican Republic, mainly because of exhaustion of better quality deposits. Brazil, as will be seen, was until very recently the only fully integrated producer. Other primary metal producers in the region are Argentina, Mexico, and Venezuela.

### Argentina

40. Argentina became a primary aluminium producer in 1974, when the smelter at Puerto Madryn, in the province of Chubut, 1350 kilometers south of BuenosAires, came on stream. Initial capacity was 140,000 tons per year, but it was increased to 152,000 tons in 1986. The smelter is owned by Aluar Aluminio Argentino SAIC, of which 51 per cent is held by Fate S.A.I.C.I., a private company producing mainly tyres. The rest of ALUAR is held by different private interests.

41. ALUAR is supplied with alumina by Alcoa of Australia under a long-term contract, which will expire in 1994. Electricity, based on hydro power, is supplied by the government under a contract with prices being lower than average in an international comparison. Given relatively low labour costs, ALUAR is judged to be an internationally competitive producer. Only a portion of its production is however exported in the form of ingots, with the rest being converted to semi-manufactured products either by ALUAR's own subsidiary, Kicsa S.A., or by independent semi-manufacturers. In an attempt to benefit from the more stable prices of processed products, producers have increasingly upgraded their products before export.

42. Production capacity in the semi-manufactured products industry is about 130,000 tons per year, covering wire rod (there are also domestic cable and wire producers), rolled products including foil, and extrusions. Although the capacity is underutilized exports of semi-manufactured and finished aluminium products have been successful.

43. Although domestic consumption of primary aluminium has increased markedly as a result of the concentration on processing, consumption of aluminium in the form of processed products has been on a more or less flat trend since the late 1970's, reflecting the slow overall economic growth. Table 7 shows consumption of primary aluminium in different end-uses from 1978 to 1987. No major shifts in the distribution of consumption appear to have taken place over that period, with the exception of a drop in consumption for electrical uses, largely attributable to a slow-down in the building of transmission lines. This sector, as well as other infrastructural investment, has obviously suffered from the country's precarious economic and financial situation.

44. Part of the reason behind the expansion of exports of semi-manufactured exports may lie in the fact that the price of ingot is fixed at a level considerably lower than the world market price 7/. The fixing of the price constituted part of the agreement under which the smelter at Puerto Madryn was set up, one of the objectives being to assure that domestic consumers of primary aluminium would not suffer a price disadvantage compared to competitors abroad.

Table 7

Evolution of primary aluminium demand in Argentina from 1978 to 1987 according to end-uses (percentages)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| Construction | 18 | 23 | 27 | 23 | 30 | 25 | 24 | 24 | 25 | 24 |
| Transport | 10 | 16 | 15 | 10 | 12 | 12 | 13 | 15 | 16 | 16 |
| Electricity | 39 | 20 | 19 | 29 | 24 | 30 | 24 | 16 | 14 | 12 |
| Domestic and office articles | 6 | 9 | 8 | 8 | 8 | 7 | 10 | 10 | 9 | 9 |
| Packaging | 16 | 15 | 16 | 16 | 15 | 13 | 15 | 20 | 19 | 18 |
| Powder and paste | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| Machinery and equipment | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Others and unspecified | 8 | 13 | 12 | 10 | 9 | 9 | 12 | 11 | 13 | 12 |

Source: ALUAR Aluminio Argentino S.A.I.C.

45. While primary ingot is mainly exported to other Latin American countries, expo_ts of semi-manufactured products go to the United States, Japan and Europe. One major obstacle to the expansion of the regional trade is the difficulty in obtaining export finance.

Brazil

46. Until 1987, Brazil was the only Latin American country to have a fully integrated industry from bauxite mining to smelting and fabricating. This was the result of the presence of a number of favourable circumstances. First, with its relatively large population, Brazil has a significant domestic market for aluminium. Secondly, the primary inputs, energy and bauxite, are available in the country, and thirdly, local aluminium using industries were developed at a relatively early date compared to other Latin American countries.

47. In 1978 the Brazilian aluminium industry was composed by Alcan, Alcoa and Companhia Brasileira de Aluminio (CBA), a Brazilian private company. The three companies were responsible for one third each of the primary metal output. The market has never been fully dominated by Alcan or Alcoa which have assigned a kind of "barometric leadership" to CBA. The Brazilian industry in 1978 was mainly involved in the international market as an importer of primary metal. Bauxite and alumina were essentially produced for domestic consumption with a traditional partial dependence on imported alumina by the Alcan smelter. In 1981/1982, owing to a severe economic recession coinciding with continuing investment in new capacity, the country reversed its traditional situation and became a net exporter of primary aluminium.

48. Production at all stages has shown an impressive growth over the period under study (see table 9). Bauxite production rose from 1.1 million tons in 1978 to 6.6 million tons in 1987, or by an average of 22 per cent annually. A large portion of this is exported, mainly to Venezuela, Canada and the UnitedStates. Alumina production expanded from 434,000 tons to 1.396,000 tons over the same period, corresponding to an average annual growth rate of 14 per cent. The alumina is mainly used domestically, and additional quantities, needed for the primary aluminium industry, are imported from Suriname, Jamaica, Venezuela and the United States. Primary aluminium production increased from 186,400 tons in 1978 to 843,500 tons in 1987, or by 18 per cent annually on average. Exports, which have increased rapidly and reached over 300,000 tons in 1987, go mainly to Japan, the Netherlands and the United States. In the following, the activities of the main Brazilian producers are briefly reviewed.

Alcan

49. In 1915 Alcan, at that time an Alcoa subsidiary, established itself in Brazil to sell imported semi-finished products. In the 1940's it acquired fabricating companies (kitchenware) and in 1950, when CBA's plans to produce aluminium were already underway, it started a minor smelting operation.

50. Alcan presently operates two smelters in Brazil (Ouro Preto in Minas Gerais and Aratu in Bahia) with a total capacity of 118,000 tons per year (see table 8). Its Aratu smelter is dependent on third party alumina. The company has hydroelectrical capacity corresponding to 20 per cent of its needs and owns a share in a coke producing plant. It also produces all sorts of semi-finished and finished products. In fact, semi-fabricating and fabricating is the major activity of the company in Brazil and it considers appropriate for the future to rely on external sources of primary metal.

Alcoa

51. Alcoa established itself in Brazil in the 1960's and in 1970 started its primary metal production with a smelter in Pocos de Caldas in Minas Gerais. During the 1970's it was the main supplier of primary metal to non-integrated producers. In 1980 however it followed the general rule and started its integration downstream through the take-over of independent companies. Today it is a producer of all kinds of semi-finished and finished products.

52. In the late 1970s Alcoa took a major decision for the Brazilian aluminium industry and launched with Billiton the largest project in the country (ALUMAR), as part of the company worldwide restructuring strategy. In 1984 the project's first phase of 100,000 tons annual capacity started operation. In 1986 the second phase was brought into operation, bringing capacity to 245,000 tons, and the third phase (to reach 380,000 tons) is under consideration (see table 9). The Alumar project includes an alumina refinery but not mining. Although Alcoa has good quality reserves in the north of the country it has so far chosen to buy bauxite from MRN instead of investing in a completely new mine site.

Companhia Vale do Rio Doce ( CVRD)

53. This state company is well known for its iron ore mining operations and trading. It was one of the first developing country companies to build its own marketing ability in an international context. In the early 1970's when the large bauxite reserves in the Amazon region were identified, CVRD was assigned the role to contribute to the development of the aluminium industry.

54. The state participation in the industry can be said to have started in 1974 when CVRD took over a 46 per cent share of Mineracao Rio do Norte (MRN), which was originally a subsidiary of Alcoa and which owned bauxite reserves in the Trombetas (Para State) region. MRN (at present 46 per cent CVRD, 24per cent Alcan, 10 per cent CBA, 5 per cent Billiton International, 5 per cent Billiton Brazil, 5 per cent Norsk Hydro and 5 per cent Reynolds) started operations in 1979 with 3.5 million tons of annual capacity and is now capable of producing 6 million tons (estimated tonnage for 1988).

55. MRN is the only bauxite exporting company in Brazil through the production shares of its shareholders. It has also developed its own third party markets that has enabled it to expand beyond the partners' own needs. With only minor investment MRN could be expanded to 8 million tons per year, or even 12 million if necessary, according to the company.

56. From its first involvement in the aluminium industry CVRD planned an integrated operation and for that purpose it started talks in the early 1970's with Japanese groups interested in participating in the alumina and smelting stages. As these negotiations were maturing CVRD decided to anticipate its participation in the smelting phase through the establishment of Valesul, a medium size operation (80,000 tons) in association with Billiton (35 per cent) and Reynolds (whose 4 per cent share was in payment for the supply of technology). The ownership is now divided between CVRD (54.5 per cent) and Billiton (45.5 per cent). The opening of this smelter was welcomed by the non-integrated fabricators since the major producers were increasingly absorbing their own metal output.

57. Albras is a joint-venture between CVRD (51 per cent) and the Nippon Amazon Aluminium Co. Ltd., - NAAC (49 per cent). The NAAC is a consortium of 33 companies in which the Japanese government (through the Overseas Economic Cooperation Fund - OECF) has the largest share. Albras started operations in 1985 with an annual capacity of 160,000 tons. It is now proceeding with a second phase in order to reach 320,000 tons in 1991.

58. The Alunorte refinery project, which was orginally linked to the Albras venture, was delayed because of reluctance on the part of the Japanese partners to go ahead with it in a worldwide excess capacity situation. The Japanese consortium ended by withdrawing from the management of the project while keeping its investment in the form of non-voting preferred shares. CVRDhopes to restart Alunorte construction in 1989 (possibly with a new partner) beginning production hopefully in 1991. It may be built with a capacity of 800,000 tons per year or 1.1 million tons depending on the interest of the partners.

59. With the construction of Alunorte and completion of Albras CVRD becomes fully integrated. It will then be ready to proceed in the direction followed by other primary metal producers, that is, downstream integration.

Companhia Brasileira de Alumunio (CBA)

60. This company belongs to a private Brazilian group (Votorantim) which has operations in various other industries including lead and zinc, nickel, fluorite, cement, steel, chemicals and textiles. Since the initial planning of CBA in 1941, the aim was to establish a fully integrated and independent project. It is in fact the most fully integrated producer in Brazil generating internally 50 per cent of its energy requirements. The parent company is also a producer of caustic soda and fluorides and a partner in a coke producing plant. It also produces foil, sheets, cables, packaging materials, extrusions, etc.

61. Owing to their linkages and international leadership both Alcan and Alcoa are able to produce more sophisticated products in terms of shapes, quality control, etc. In their case (Alcan and Alcoa) this is a matter of internal decision making, involving basically a process of adaptation of new technology. CBA on the contrary has to go through a process of selection, acquisition, adaptation, absorption and eventually, development of technology. According to the company policy, this process cannot involve payment of royalities or partnerships. One of the consequences is restricting the number of potential suppliers although it implies a considerably higher degree of independence. Since CBA holds a 10 per cent share in MRN, the company plan for the future is to expand its smelting capacity in the north of the country.

Billiton

62. As observed earlier this company participates in the Brazilian industry through partnership in the Valesul project (jointly with CVRD) and Alumar (jointly with Alcoa). Billiton, like CVRD, is at present one of the main suppliers of primary metal to the domestic market but, again like CVRD, it is considering downstream integration. Since the company is also a shareholder in MRN, its operations in Brazil can be considered as integrated.

Table 8

Production capacity for bauxite, alumina and primary aluminium in Brazil (thousand metric tons gross weight per year)

| Producer | Location | 1987 | 1993 (forecast) | 1995 (forecast) |
|---|---|---|---|---|
| Bauxite | | | | |
| Alcoa | Saramenha, M.G. | 400 | 400 | 400 |
| Alcoa | Poco de Caldas, M.G. | 600 | 600 | 600 |
| CBA | Sorocaba, S.P. | 650 | 650 | 650 |
| MRN (CVRD 46 %, Alcoa 24%, (CBA 10%, Billiton 10%, Hydro 5% Reynolds 5%) | Trombetas, P.A.a/ | 6000 | 8000 | 8500 |
| Total | | 7650 | 9650 | 10150 |
| Alumina | | | | |
| Alcan | Saramenha, M.G. | 140 | 140 | 140 |
| Alcoa | Pocos de Caldas, M.G. | 190 | 190 | 190 |
| Alumar (Alcoa 66%, Billiton 34%) | Sao Luiz, M.A. | 600 | 800 | 800 |
| Alunorte (CVRD 60%, NAAC 40%) | Barcarena, P.A.b/ | 0 | 800 | 800 |
| CBA | Sorocaba, S.P. | 250 | 250 | 250 |
| Total | | 1180 | 1980 | 1980 |
| Aluminiun | | | | |
| Albras (CVRD 51%, NAAC 49%) | Belem, P.A. | 160 | 320 | 320 |
| Alcan | Ouro Preto, M.G. | 60 | 60 | 60 |
| Alcan | Aratu, B.A. c/ | 58 | 58 | 88 |
| Alcoa | Pocos de Caldas, M.G. | 90 | 90 | 90 |
| Alumar (Alcoa 66%, Billiton 34%) | Sao Luiz, M.A. | 245 | 245 | 380 |
| CBA | Mairinque d/ | 170 | 170 | 340 |
| Valesul | Santa Cruz, R.J. | 86 | 86 | 86 |
| Total | | 869 | 1029 | 1364 |

a/ Capacity could reach as much as 12 million tons per year in the 1990's.

b/ An expansion to 1.1 million tons instead of 800,000 tons per year is being considered.

c/ A further 30,000 tons per year expansion could be undertaken depending on the availability of energy.

d/ Alternative expansion plans call for an increase to 270,000 tons per year.

Sources: CVRD, ABAL (Associacao Brasileira do Aluminio) 1987, UNCTAD secretariat.

Table 9

Supply and demand in the Brazilian bauxite/alumina/alumimium industry 1978 to 1987
(thousand metric tons gross weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| Bauxite: | | | | | | | | | | |
| Production | 1130.6 | 1642.2 | 4152.0 | 4463.0 | 4187.0 | 5239.0 | 6433.0 | 5846.0 | 6446.0 | 6566.5 |
| Exports | 4.0 | 516.2 | 2679.4 | 4126.3 | 2991.3 | 3988.6 | 4320.0 | 3320.0 | 3113.2 | n.a. |
| Imports | 10.1 | 15.6 | 13.2 | 15.0 | 8.6 | 5.0 | 11.2 | 8.8 | n.a. | n.a. |
| Alumina: | | | | | | | | | | |
| Production | 434.0 | 449.0 | 493.0 | 520.0 | 552.0 | 629.0 | 882.0 | 1096.0 | 1197.0 | 1396.1 |
| Exports | 0.8 | 0.4 | 0.2 | 0.6 | 5.0 | 7.0 | 43.2 | 94.2 | 77.2 | 87.0 |
| Imports | 24.4 | 70.6 | 64.2 | 26.8 | 87.0 | 202.8 | 183.8 | 236.0 | n.a. | n.a. |
| Primary Aluminium: | | | | | | | | | | |
| Production | 186.4 | 238.3 | 260.6 | 256.4 | 299.1 | 400.7 | 455.0 | 549.4 | 757.3 | 843.5 |
| Exports a/ | 0.0 | 0.0 | 0.0 | 2.2 | 3.7 | 116.3 | 148.2 | 177.2 | 323.5 | 430.9 |
| Imports a/ | 60.3 | 51.8 | 46.7 | 28.2 | 10.8 | 2.9 | 4.6 | 2.6 | 1.4. | 2.3. |
| Consumption | 240.4 | 265.7 | 296.4 | 261.7 | 281.9 | 270.6 | 294.8 | 347.5 | 423.7 | 430.3 |
| Recovered scrap: | | | | | | | | | | |
| Domestic | 30.9 | 35.6 | 38.5 | 36.5 | 39.2 | 40.9 | 47.0 | 52.0 | 57.5 | 61.0 |
| Imported | 22.2 | 22.8 | 11.1 | 5.3 | 3.7 | 4.1 | 0.2 | 0.7 | 3.1 | 4.9 |
| Processed products: | | | | | | | | | | |
| Exports | 3.9 | 8.6 | 11.5 | 18.6 | 11.7 | 53.3 | 57.3 | 36.0 | 33.5 | 26.0 |
| Imports | 14.8 | 27.3 | 22.3 | 8.7 | 3.9 | 2.8 | 5.0 | 3.8 | 2.2 | 6.3 |
| Consumption | 304.4 | 342.8 | 356.8 | 293.6 | 317.0 | 289.8 | 286.4 | 355.8 | 428.5 | 411.0 |

a/ Unwrought aluminium

Sources: ABAL 1987, UNCTAD secretariat.

63. On the consumption side, growth, although clearly above world average, has been less impressive than the increase in production. Consumption of primary aluminium increased at an average rate of 6.7 per cent a year from 1978 to 1987, reflecting expansion in the semi-manufactured products sector. Consumption of processed products has grown more slowly, at an average rate of 3.4 per cent per year. The consumption of processed products has also developed unevenly, due to the constraints imposed on the domestic aluminium consuming industry by the financial environment, in particular the scarcity of investment funds and foreign exchange. Transport and packaging are the end-use sectors that have shown the strongest growth, and this trend is expected to continue in the future. Use of aluminium in construction, on the other hand, has stagnated. Table 10 shows the composition of consumption in 1987.

64. More recently in 1987 and 1988, aluminium consumption has been constrained by a shortage of metal. The reason for this shortage is that since domestic prices are controlled, primary producers have preferred exporting their metal to benefit from the dramatic price increases that have taken place since 1987. Consequently, although the price to domestic semi-fabricators is favourable, they have had difficulties obtaining sufficient material. This has created problems in particular for independent semi-fabricators. Capacity utilization in the semi-manufacturers industry is however very high, and most producers plan to expand capacity significantly in the next few years.

65. Brazilian trade in aluminium products with other Latin American countries is limited. The small size of most of the markets does not justify investment in active marketing. High transport costs, difficulties of obtaining export finance and the slowness of customs and foreign exchange procedures in most Latin American countries act as further obstacles to a trade expansion.

Dominican Republic

66. Bauxite mining in the Dominican Republic, which had been carried out by Alcoa since the 1940's and which in the mid 1970's reached over 1.3 million tons, was discontinued in 1982 owing to depleted reserves. In 1987, however, production was again started by the private company Ideal Dominicana. Initially, the major share of output was exported to Suriname to provide feed for the Paranam refinery, partly owned by Alcoa, since Alcoa's mine in Suriname had been closed by civil unrest. Production is now proceeding at a rate of 450,000 tons per year. The Dominican republic has no facilities for downstream processing.

Table 10

Composition of aluminium consumption in Brazil in 1987
according to type of products and end-uses (thousand metric tons)

| | Construction | Transport | Electric industry | Consumer products | Packaging | Machinery and equipment | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Sheet and plate | 25.6 | 14.2 | 3.3 | 37.5 | 12.3 | 5.1 | 5.2 | 103.2 |
| Foil | -- | 1.6 | 2.3 | 3.7 | 22.0 | 0.5 | 0.4 | 30.5 |
| Extrusions | 55.8 | 12.0 | 4.6 | 13.6 | -- | 8.9 | 4.3 | 99.2 |
| Cable and Wire | -- | -- | 71.1 | -- | -- | -- | 0.5 | 71.6 |
| Foundry products | 0.5 | 56.0 | 2.2 | 5.9 | -- | 6.2 | 1.4 | 72.2 |
| Powder and paste | -- | -- | -- | -- | -- | -- | 9.9 | 9.9 |
| Destructive uses | -- | -- | -- | -- | -- | -- | 23.2 | 23.2 |
| Others | -- | -- | -- | -- | -- | -- | 1.2 | 1.2 |
| Total | 81.9 | 83.8 | 83.5 | 60.7 | 34.3 | 20.7 | 46.1 | 411.0 |

Source: ABAL 1987

Guyana

67. The third largest bauxite producer in Latin America during the 1970's, Guyana also used to have a near world monopoly in calcined refractory grade bauxite (80 per cent of the market in 1980) which is now shared with China. The aluminium industry in Guyana was nationalized in 1971 when the government expropriated the Alcan subsidiary which ran the bauxite and alumina operations.

68. The Bauxite Industry Development Company Ltd., (BIDCO) is the government entity responsible for research, development and planning for the bauxite and alumina industries. Operations are carried out by its subsidiary Guyana Mining Enterprise Ltd. (Guymine).

69. Apart from being a large producer of refractory grade bauxite (which commands a higher price than the metallurgical grade) because of the availability of very high grade ore, mine operations in Guyana are also distinguished by having the thickest overburden. In the main producing region (Linden) the overburden thickness varies from 50 to over 60 meters yielding a stripping ratio estimated to range from 8:1 to 9:1.

70. Guyana's bauxite production declined from 4.0 million tons in 1978 to 3.2million tons in 1987. Potential production could, however, exceed 4 million tons. The main product of the country is calcined refractory grade bauxite. The other products are metallurgical grade (historically and on average equivalent to half of the country's output), chemical and abrasive grades bauxite. During the 1980's the state company has had difficulties in meeting its targeted sales of refractory grade bauxite, partly for domestic reasons but also because of increased Chinese production.

71. Until 1981 the Linden Alumina refinery, built in 1961 by Alcan and rated at 300.000 tons per year, was in operation. In early 1982 it was closed for modernization but has not been re-opened since then for lack of financing. It is estimated that over US$ 30 million would be required for that purpose. The government has held conversations with interested foreign parties and an agreement with Hydro Aluminium is reported to have been reached recently.8/ Major investments will also be needed to develop new mine sites as the existing ones approach depletion. The government has recently concluded an agreement on a joint venture with Reynolds to develop the Orami deposit, where mining would start before the end of 1989 and where as much as 2.6 million tons per year could be produced 9/. In the early 1980's the government considered the possibilities of constructing a hydroelectric power station and an aluminium smelter but financing was not available.

Haiti

72. Bauxite was produced in Haiti from 1957, with Reynolds as the operating company. Production was relatively stable, at between 500,000 and 800,000tons per year. In 1982, mining was discontinued because of depletion of economic reserves. There is no downstream processing in Haiti.

Jamaica

73. Still the major bauxite producer in the region, this country ranked third in world supply in 1978, although production has fallen since the government's imposition of a bauxite and alumina levy in 1974. The levy was imposed partly as a response to the tripling of the imported oil price in 1973 although it can also be said to reflect a well planned decision by the government in order to increase its share of the revenues. Since the creation of the levy system there have been repeated and lengthy negotiations between the government and the producing companies, with the government trying to maximize its revenue and the foreign companies pressing for a reduction of costs by cutting production and delaying investment decisions.

74. Jamaican bauxite and alumina production did not fall immediately upon introduction of the levy, but remained at levels of about 13 million tons of bauxite and 2 to 2.5 million tons of alumina for some years. In 1979 in response to complaints from the companies, the levy was reduced from 7.5 per cent of the realized primary aluminium price (calculated on the basis of 4.3tons of dry bauxite to one ton of aluminium) to 5.5 per cent, with variations according to production volume. In 1982, however, demand fell drastically, and production of bauxite and alumina was reduced to 9.4 million tons and 1.8million tons respectively. In early 1985, facing a situation of continuing excess world capacity for bauxite and alumina and with cheaper supplies of alumina coming mainly from Australia (at prices of around 110 to 120 US dollars per ton, compared to production costs in Jamaica of 220 to 230 dollars), Alcoa announced that it intended to close down the Clarendon refinery and Kaiser and Reynolds took the Alpart mine and refinery out of operation (see following paragraph) Jamaican production has since then been more or less level, although in 1987 and 1988 it began to move back towards previous levels.

75. The bauxite/alumina industry in Jamaica is presently composed of the following operations (see also table 11):

(i) Alcoa's wholly owned subsidiary (Jamalco) owns 49 per cent, with the government holding the remaining 51 per cent, in the Clarendon mine and alumina refinery. This distribution of ownership is based on a recent agreement as of March 1988, according to which Jamaica increased its share by an extra 45 per cent from the previous 6 per cent. In 1985 the Clarendon refinery was leased to the government for two years as the American company announced its closure. The Jamaican government kept Alcoa as a contracted manager during the negotiated period and as early as 1986 Alcoa was considering a possible return to an active operating status at Clarendon. The agreement settled a more than year-long dispute. During the time when the government leased the operation the main part of production was sold to the March Rich organization with a large share going to toll smelting in the United States. It is expected that sales to Marc Rich will continue for some years.

(ii) Alcan through its subsidiary Jamalcan operates two mines (Schwallenberg and Kirkvine) and two refineries (Kirkvine and Ewarton) with a minor participation of 7 per cent by the government since 1979 as a result of negotiations involving the levy system. Since 1982 the Ewarton refinery has been operating below its rated capacity because of excess capacity of alumina in the Alcan system. The government urged the company to reestablish its full operation capacity and offered to buy all the alumina which could not be sold by the company. Alcan in its turn insisted that a higher rate of capacity utilization at its Ewarton refinery could only be discussed together with a reduction of the bauxite levy. An agreement was reached in late August 1988, whereby the levy becomes chargeable as a normal production cost, with company profits liable to corporate tax. In the event of either party being unable to market its share of production the other partner would be entitled to purchase the alumina at production cost.

(iii) The third major foreign operation in Jamaica is Alpart, which was a joint venture between Reynolds and Kaiser (50 per cent each). The operation acquired this configuration after Atlantic Richfield's sales of its 27 per cent share in the company in 1985. In 1985 this integrated operation was closed by the parent companies who raised the poor market condition plus the high costs of the plant which had been operating at half of its capacity since 1982. In December 1988, an agreement was reached according to which the mine and the refinery would be reopened in March 1989. Under the the terms of the agreement Kaiser would become the owner of 65 per cent of the operation, while Hydro Aluminium would be the smaller partner with 35 per cent.

(iv) Kaiser Jamaica Bauxite Company is a joint-venture between Kaiser (49 per cent) and the government (Jamaica Bauxite Mining Ltd) since 1977. The production is split roughly in proportion to share holdings with a large part of the Jamaican taking being tied to an export contract with the USSR. Kaiser's share of the output is used to feed its high temperature alumina plant in the United States (Gramercy).

Table 11

Jamaica: Bauxite and alumina production capacities by plant
(thousand metric tons/year)

| | Bauxite | Alumina | Notes |
|---|---|---|---|
| Jamalco (Clarendon) | 1850/2500 | 800 | Refinery capacity to be expanded to 1 million tons |
| Jamalcan | | | |
| Kirkvine/Schwallenberg | 1500/1660 | 560 | |
| Ewarton | 1500 | 550 | |
| Alpart | 3100 | 1180 | |
| Kaiser Jamaica Bauxite Co., | 4200 | | |

Source: UNCTAD secretariat.

76. Another important factor in the Jamaican industry is the Bauxite Aluminium Trading Company of Jamaica LTd. (BATCO), which is the government arm for trading its share in the various projects in which it participates. This organization has been successful in concluding export contracts, sometimes in the form of barter deals, with a number of countries. Other governmental agencies include the Jamaica Bauxite Mining Ltd., which represents the government in the Kaiser joint-venture and which acquired Reynolds' mining properties (the Lydford mine) in 1984 after the company closed down the mine, and the Jamaica Bauxite Institute (JBI), which is in charge of the economic and startegic planning of the sector, including negotiations with foreign investors, the structure of levy and taxation systems, and mining leases.

77. As regards downstream processing, there is one small extrusion plant owned by Alcan, with a capacity of 4,300 tons a year. Most of the production is consumed domestically, although some export sales are made to neighbouring Caribbean countries.

Mexico

78. Mexico has one producer of primary aluminium, ALUMSA, a subsidiary of Grupo Aluminio, of which Alcoa holds 45 per cent. The smelter entered production in 1963 with an annual capacity of 22,000 tons. Capacity was increased to 44,000 tons per year in the late 1960's and again in 1987 to 66,000 tons per year. Alumina is supplied by Alcoa from the United States on a long-term contract expiring in 1990/91. The major part of the production is sold domestically, with small amounts exported mainly to the United States. In June 1988, ALUMSA ceased to export primary metal in order to concentrate on supplying the domestic market.

79. One distinguishing characteristic of the Mexican aluminium industry is the large secondary smelter sector. Total production capacity in this sector is estimated to be about 175,000 tons per year 10/ although production is much lower. A high proportion of the scrap used is imported from the United States.

80. Production capacity in the semi-manufactured products sector was 168500 tons at the beginning of 1988 11/, although in this sector too, production is lower than capacity. Relatively small amounts of semi-manufactured products are exported, mainly to the United States and to countries in the Central American region. Imports of semi-manufactured products have decreased in later years, with the exception of can stock, which is imported from the United States.

81. Table 12 shows aluminium supply and demand in Mexico from 1978 to 1987. One factor overshadows all others as a determinant of developments: the fall in oil revenues from 1982 on, and the resulting external debt crisis. Consumption increased rapidly until 1981 and has fallen ever since, with the exception of a temporary peak in 1985. The fall in domestic demand, combined with low competitiveness on export markets, has created great structural problems.

Table 12

Supply and demand for aluminium in Mexico

(thousand metric tons) a/

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary production | 43.1 | 43.2 | 52.6 | 53.2 | 41.2 | 39.7 | 44.0 | 42.7 | 37.0 | 60.2 |
| Imports of unwrought metal | 39.0 | 56.1 | 63.5 | 58.8 | 32.3 | 10.8 | 26.0 | 35.7 | 16.1 | 8.9 |
| Exports of unwrought metal | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.6 | 0.6 | 0.2 | 2.7 | 3.1 |
| Recovery of domestic scrap | 12.3 | 14.9 | 17.1 | 20.3 | 25.8 | 15.1 | 19.6 | 22.1 | 13.8 | 8.8 |
| Imports of scrap | 3.7 | 9.2 | 7.0 | 8.8 | 11.5 | 6.7 | 19.2 | 43.0 | 19.0 | 11.0 |
| Exports of scrap | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.3 | 1.4 | 4.8 | 5.3 | 6.7 |
| Total net raw material supply | 98.1 | 123.4 | 130.2 | 130.7 | 110.6 | 71.4 | 106.8 | 138.5 | 78.0 | 79.1 |
| Imports of semi-manufactured products | 24.9 | 25.6 | 33.9 | 60.0 | 45.6 | 5.6 | 14.3 | 24.3 | 18.8 | 22.3 |
| Exports of semi-manufactured products | 1.5 | 1.0 | 0.4 | 0.2 | 0.3 | 0.5 | 2.1 | 2.3 | 1.1 | 5.2 |
| Imports of finished products | 1.1 | 1.5 | 8.5 | 14.2 | 5.1 | 0.6 | 1.0 | 1.4 | 1.8 | 12.9 |
| Exports of finished products | 2.2 | 2.1 | 3.0 | 2.5 | 0.8 | 0.8 | 4.0 | 9.8 | 3.0 | 6.3 |
| Apparent consumption | 120.3 | 147.5 | 169.3 | 202.1 | 160.2 | 76.4 | 116.0 | 152.1 | 94.5 | 102.8 |
| Inventory change | +0.8 | +0.3 | -0.5 | -2.5 | -8.9 | +5.9 | +1.6 | -2.2 | +1.5 | +2.1 |
| Consumption | 121.1 | 147.8 | 168.8 | 199.6 | 151.2 | 82.2 | 117.5 | 149.9 | 96.1 | 104.9 |

Source: Instituto Mexicano del Aluminio: Estadisticas 1987.

a/ Totals may not add up because of rounding.

82. The primary metal producer is hemmed in by high costs, due to high energy prices and rapid domestic inflation, on one side, and by a controlled domestic price (lower than the international price) for ingot on the other. While the pressure could be reduced by exporting primary metal, the producer has, as already mentioned, renounced exports in favour of a concentration on the domestic market. Increasing exports would of course also deprive the primary producer of raw materials for its own downstream production.

83. The semi-manufacturing sector suffers from excess capacity in relation to the reduced domestic demand, and high fixed costs resulting from earlier investments during the period of expansion. Increasing exports is not a viable option since domestic costs are rising and the exchange rate is fixed to the US dollar. In addition, since a large part of production is based on imported raw materials with tariffs on unwrought metal and scrap being 10 and 5per cent respectively 12/ it is difficult for this sector to achieve any degree of competitiveness on the international market.

Surinam

84. Like Jamaica, Surinam is heavily dependent on the aluminium industry for foreign exchange earnings. It has been a producer and exporter of bauxite since 1922 and of alumina since 1965. In the 1960's, it was the world's second largest bauxite producer after Jamaica. It is also the only Caribbean country with primary smelting capacity.

85. The structure of the Surinam industry is briefly summarized in the following:

(i) Alcoa: Through its wholly owned subsidiary Surinam Aluminium Company (Suralco), Alcoa owns the Moengo mine, which has a potential capacity of 4.5 million tons per year. Production during the 1980's has generally been around 1.5 million tons. Suralco also owns the Lelydorp mine, which was "temporarily" closed down in 1984, and 24 per cent of Billiton's Onverdacht mine (see below). The Paranam alumina refinery, with a capacity of 1.4 million tons per year, is 55 per cent owned by Suralco, with the balance held by Billiton. The refinery is supplied by the Moengo and Onverdacht mines. Part of the output goes to the local smelter and the rest is handled by Alcoa and Billiton respectively. The Paranam smelter, with a capacity of 60,000 tons per year, is wholly owned by Suralco. Its output goes into the Alcoa system.

(ii) Billiton: The Onverdacht mine, with a capacity of just above 2million tons, is operated by Billiton, who is also the majority shareholder. Most of the output goes to feed the Paranam refinery, with the balance being exported. A recent decision to limit annual output to 1.8 million tons in order to prolong the life of the mine and ensure sufficient bauxite supplies to the refinery may signal the end of exports.

86. In 1979, the government and Reynolds studied the possible development of bauxite deposits in the Bakhiris region in an area leased to Reynolds. This company eventually decided not to participate, and the government announced its intention to develop the deposit, which has been called a mini-Trombetas owing to similarities to the Brazilian deposit. The necessary investment, including infrastructure, has been estimated at around US$ 150 to US$ 200 million, a sum that, given the present economic and political situation of the country, would require foreign participation.

87. In 1978 the annual mining capacity in Surinam was estimated to be 7million tons. After experiencing a peak production level of more than 7.5million tons in 1972 the country suffered a drastic fall in production after 1974 with output levelling off at just under 5.0 million tons until 1982 when, in line with other major producers, its bauxite output fell to around 3.0million tons annually.

88. As in the case of Jamaica, the reduction of bauxite production by the foreign companies after 1974 cannot be exclusively related to the imposition of the levy system by the government. Again it must be interpreted in a worldwide perspective including the search by major international producers for lower cost areas of production.

89. In 1986, in an attempt to encourage foreign investment, the government announced the suspension of the bauxite levy. At the same time Alcoa and Billiton revealed modernization plans of their operations which would mean a US$ 150 million investment but which would also require other governmental actions such as a devaluation of the guilder and a labour productivity deal. These and other economic measures (such as controlling public expenditure) are also seen as necessary if the country wants to attract foreign investment.

90. During most of 1987 both Alcoa's mine and smelter were shut because of civil unrest. Bauxite had to be imported from the Dominican Republic to feed the alumina refinery (which was still being partly fed by the Onverdacht mine). The aluminium smelter reopened in July 1988 operating at half its capacity (30,000 tons) this being the intended level of operation for the foreseeable future. This decision is partly related to the low water level at the Afobaka dam which supplies the smelter with electricity. If any additional energy becomes available it will be used in the refinery which has just been converted from oil to electrical energy. According to government sources the World Bank has already carried out feasibilities studies for a new dam at Kabaloo which could make additional smelting capacity possible. In view of the civil unrest, however, it is uncertain whether the project could be realized using World Bank finances.

Venezuela

91. Until the early 1980's Venezuela could not be considered a major producer of aluminium. Today, with two primary aluminium producing companies, three additional plants under construction and four others at the planning stage, it is becoming one of the largest integrated aluminium producers in the world with a projected production of 2 million tons per year after 1995. (See table14.)

92. The key institutional element in the development of the Venezuelan aluminium industry is the Corporacion Venezolana de Guyana (CVG), which is placed directly under the country's president, and which is a shareholder in all plants in operation and a partner in all projects under construction or in the planning phase. It is in charge of the coordination and development of the Guyana Region, including hydroelectric resources, mining, metallurgy, agriculture, and all state companies in the region. It also has a subsidiary trading company, CVG International.

93. Bauxiven is the state company created to develop and exploit the bauxite deposits found in the mid-1970's at Los Pijiguaos in western BolivarState about 600 kilometers from the aluminium complex at Ciudad Guyana. This project, which will complete the vertical integration of the industry, has fallen somewhat behind schedule and is expected to be completed in early 1990, although some bauxite was produced already in 1987. CVG holds 54 per cent of the shares, with the rest owned by the Fondo de Inversiones de Venezuela (FIV). The projected capacity is 4 million tons and CVG already plans an expansion to 8 million tons which would be required when the country achieves its 2 million tons target in primary aluminium.

94. The alumina refinery Interamericana de Alumina S.A. (Interalumina), located at Ciudad de Guyana, started production in 1983. The main shareholder is the FIV with 87.4 per cent. CVG owns 9.2 per cent and Alusuisse 3.4per cent (Alusuisse carried out the initial feasibility study). Design capacity is 1.1 million tons per year, but production in 1987 was 1.36 million tons. An expansion to 2 million tons per year is under way and is planned to be completed in the second half of 1991. Further expansion to 3 and, eventually, 4 million tons per year, may take place either through the addition of new capacity at the present site or through the construction of a new plant at LosPijiguaos. At present, and until Bauxiven becomes fully operational, bauxite is imported from Surinam and from MRN in Brazil. Most of the production goes to the local smelters, but since these cannot yet absorb the entire output, a relatively large quantity (430,000 tons in 1987) is exported.

95. Aluminio del Caroni S.A. (Alcasa) was the first smelter to be built in Venezuela. The main shareholder is the FIV with 75 per cent. CVG holds 10per cent, and Reynolds 15 per cent of the shares. The present capacity is 125,000 tons per year. An expansion of 90,000 tons is taking place in 1989 and a further expansion of 180,000 tons is planned for 1991. Alcasa will then be the world's - and Venezuela's - second largest smelter. In addition to supplying domestic producers of semi-manufactured products with ingots, Alcasa itself has considerable downstream processing capacity and produces both sheet and foil. Additional investments in these sectors are under way. Alcasa also owns half the shares (Reynolds owns the other half) of Aleurope, a Belgian-based foil and rolled products company, which it supplies with ingot. Finally, Alcasa provides the only example of direct investment in another Latin American country, it being part owner of a rolling mill in Costa Rica (Alunasa).

96. Industria Venezolana de Aluminio S.A. (Venalum), which began production in 1978, was the second smelter built in Venezuela. It is a joint venture between FIV (61.2 per cent), CVG (18.8 per cent) and a group of Japanese companies, of which Showa Denko K.K. holds the largest share (7 per cent). Capacity has been expanded from 70,000 tons initially to 290,000 tons (production in 1987 actually reached 304,000 tons). Venalum is currently undertaking an expansion programme which will add 175,000 tons of capacity. Of the output, 60 per cent is at present taken by the Japanese partners, 20 per cent go to Sural, a privately owned Venezuelan producer of semi-manufactured products, and the rest is sold to other customers, mainly in the United States and in Latin America. Venalum recently acquired 20 per cent of the American extrusion company Wells Aluminium, which it will supply with metal corresponding to between 40 and 60 per cent of Well's needs (30,000 to 50,000 tons per year).

97. Seven new primary aluminium projects are under consideration in Venezuela, with three already under construction. These include Alisa (Aleaciones Ligeras S.A.), a joint venture between CVG (30 per cent) and the Ripesa private investment group (70 per cent), Alusur, with participation by CVG,

Sural and Alcoa, and Aluyana, a joint venture between CVG, FIV, Italimpianti (a subsidiary of the Italian state owned holding company IRI) and Techint (an Italian engineering company). The other four projects being studied are: Alamsa (Alcasa, Austria Metal and Pechiney) with a planned capacity of 180,000 tons per year; Vexxal de Aluminio (CVG and Asea Brown Bovery) also planned for 180,000 tons; Aldanca (CVG and local Venezuelan capital) with 190,000 tons per year; and finally Aluguay (CVG, Alumax and another foreign partner, possibly Alusuisse) planned for 180,000 tons per year. Table 13 shows present and planned capacities.

Table 13

Venezuela Production capacity in bauxite, alumina and aluminium (thousand metric tons per year)

| | 1987 | 93 | 95 | 2000 |
|---|---|---|---|---|
| Bauxite | | | | |
| Bauxiven | 700 | 6.000 | 6.000 | 8.000 |
| Alumina | | | | |
| Interalumina | 1.300 | 2.000 | 2.000 | 4.000 |
| Aluminium | | | | |
| Alcasa | 125 | 395 | 395 | 395 |
| Venalum | 290 | 465 | 465 | 465 |
| Alisa | | 60 | 90 | 246 |
| Alusur | | 120 | 120 | 120 |
| Aluyana | | | 195 | 390 |
| One or a combination of the four new planned smelters | | | 180 | 400 |
| Total smelter capacity | 415 | 1.040 | 1.445 | 2.016 |

Source: Guyana Program, CVG, October, 1988; Interviews with Interalumina and Venalum; UNCTAD secretariat.

98. Venezuela also has a large semi-manufactured products sector. In addition to Alcasa and Sural, which produces mainly wire rod, wire and cables, it includes Pivensa, a sheet mill opened in 1988 with a capacity of 40,000 tons per year, Alreyven, a Reynolds subsidiary producing extrusions, and many other smaller producers. Total semi-manufactured capacity in 1988 was about 400,000 tons, although capacity utilization was only about 50 per cent 13/. There is also a secondary smelter, Bera de Venezuela S.A., which is owned by the Copenhagen based East Asiatic Co., Ltd.

99. Aluminium consumption has grown rapidly in Venezuela, with consumption of primary metal increasing from 69,000 tons in 1978 to 145,000 tons in 1987. Additional increases will occur as semi-manufactures production grows. It should be stressed that the strategy of the industry according to CVG is the internationalization of downstream processing, seeking not only higher added value but also market outlets for the primary production. The recent acquisitions of overseas downstream processors by Alcasa and Venalum should be seen in this light. Table 14 shows the development of bauxite, alumina and aluminium supply and demand in Venezuela from 1978 to 1986.14/

Table 14

Supply of and demand for bauxite, alumina and aluminium in Venezuela (thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|
| Imports of bauxite | 6.0 | 66.7 | 34.3 | 32.7 | 67.0 | 1719.2 | 2522.2 | 2404.2 | n.a. |
| Production of alumina | -- | -- | -- | -- | -- | 560.0 | 1139.0 | 1135.0 | 1269.0 |
| Exports of alumina | -- | -- | -- | -- | -- | 62.0 | 349.2 | 455.0 | 496.2 |
| Imports of alumina | 151.0 | 383.8 | 503.8 | 696.6 | 646.0 | 270.2 | 7.6 | 7.4 | n.a. |
| Production of primary aluminium | 67.1 | 210.3 | 321.3 | 313.5 | 273.6 | 338.0 | 387.0 | 404.0 | 421.0 |
| Exports of unwrought metal | 28.1 | 123.4 | 217.3 | 239.0 | 208.5 | 292.0 | 179.0 | 297.0 | 247.0 |
| Imports of unwrought metal | -- | 9.1 | 0.2 | 0.4 | 0.9 | 0.3 | 0.4 | 3.0 | 6.0 |
| Recovery of scrap | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 20.0 | 14.0 | 21.0 | 24.0 |
| Total net supply of raw materials | 49.0 | 106.2 | 114.2 | 84.9 | 76.0 | 66.3 | 222.4 | 131.0 | 204.0 |
| Exports of processed products | -- | 23.0 | 37.1 | 24.4 | 0.2 | 22.0 | 68.0 | 106.0 | 103.0 |
| Imports of processed products | 27.1 | 15.3 | 24.8 | 23.8 | 25.7 | 13.0 | 21.0 | 19.0 | 17.0 |
| Apparent consumption | 76.1 | 98.4 | 101.9 | 84.3 | 101.5 | 60.0 | 179.0 | 44.0 | 118.0 |
| Inventory change | -9.1 | -10.2 | -5.2 | -23.4 | -7.1 | +46.0 | -77.0 | +37.0 | +1.0 |
| Consumption | 67.0 | 88.3 | 96.7 | 60.9 | 94.4 | 116.0 | 102.0 | 81.0 | 119.0 |

Source: Alcasa, quoted in The Aluminum Association: Aluminum Statistical Review for 1987, Washington, D.C.; and UNCTAD secretariat.

Other countries in the Latin American/Caribbean region

100. In addition to the countries reviewed above, several other countries in the Latin American/Caribbean region produce semi-manufactured and finished products of aluminium. With the exception of Colombia, however, production is very small. The plants are generally small and the technology used is old. Present production is in most cases well below capacity, given the contraction of demand that has taken place in many of these countries as a result of their financial problems. In almost all cases, output is intended for the domestic market only, although Costa Rica exports some semi-manufactured products (sheets), mainly to other Central American countries. Table 15 represents an attempt to estimate production capacities for different types of semi-manufactured products in the countries concerned. It should be noted that the estimates are very uncertain and that they are likely to understate the actual production capacity in the countries concerned.

Table 15

Production capacity for semi manufactured products in some Latin American countries (thousand metric tons per year)

| | Rolled products excluding foil | Foil | Extrusions | Total |
|---|---|---|---|---|
| Chile | 0.6 | | 4.0 | 4.6 |
| Colombia | 2.0 | 4.5 | 23.5 | 30.0 |
| Costa Rica | 10.0 | 2.5 | | 12.5 |
| Ecuador | | | 6.0 | 6.0 |
| El Salvador | 4.0 | | 3.0 | 7.0 |
| Panama | 3.0 | | 3.0 | 6.0 |
| Peru | 3.0 | | 6.0 | 9.0 |
| Uruguay | 1.0 | 0.4 | 2.3 | 3.7 |
| Total | 23.6 | 7.4 | 47.8 | 78.8 |

Source: UNCTAD secretariat and World Aluminium, A Metal Bulletin Databook, Worcester Park, Surrey, England, 1988

C. Production gaps between different stages of processing: Latin American and Caribbean producers in an international context

101. In 1978, of the Latin American and Caribbean countries producing bauxite, only Brazil had an integrated industry from mining through to refining, smelting, and fabricating. Thus, although Brazil was the smallest bauxite producer, with just over five per cent of the total Latin American/Caribbean output, it was the largest aluminium producer. Of the other bauxite producing countries in the region only Suriname had some smelting capacity which absorbed less than 10 per cent of its mine output and around 10 per cent of its alumina production. Argentina, Mexico and Venezuela were the other primary metal producing countries in the region, but none of the them had any production capacity in the intermediate phases. Their smelters were basically exploiting the availability of cheap energy and a relatively significant domestic market.

102. At the alumina production stage the picture was somewhat more balanced. Suriname, a major exporter of bauxite, was able to develop an important refining capacity which although not sufficient to absorb all its mine output was enough to process 50 per cent of it. Jamaica, the largest producer in the area, did not (and still does not) have smelting capacity since it lacks the necessary energy potential. But the country did struggle to have some refining capacity and in fact it was one of the first bauxite exporting countries to have a refinery when in the 1950's Alcan decided to set up an alumina plant. Other companies operating there did not follow this decision at first because of tariff barriers in the United States. In 1978 Jamaica could absorb only about 35 per cent of its mine output (13.5 million tons of bauxite produced, compared to 2.1 million tons of alumina, corresponding to a ratio of 6.3.1, compared with the average 2.2:1 for a full integration). Guyana, which ranked third in the Latin American/Caribbean area in terms of bauxite output, used to have a small processing capacity in 1978. But as has been noted above this plant has been out of operation since 1982. In 1978 Brazil had a bauxite/alumina ratio above 2.2 due essentially to technical reasons. It was in fact a minor importer of alumina since one of Alcan's smelters was not integrated.

103. At the end of the period (1987) the picture is the following (see table16):

(a) Brazil still has the largest smelting capacity producing 843,500 tons in that year and although it has been able to develop bauxite production capacity for export it is still marginally dependent on imported alumina (around 20 per cent of its needs).

(b) Argentina has expanded its primary aluminium production capacity but due to lack of the appropriate mineral resources it is non-integrated backwards.

(c) Mexico has kept the same position as in 1978 although it has developed more semifinished and finished production capacity.

(d) Venezuela has shown the most dramatic change in its industry structure although much of this change had not yet fully materialized in 1987. As was seen earlier, Venezuela will have a fully integrated industry in 1991 when the Los Pijiguaos mine reaches its full production capacity. Besides becoming a major metal producer it is also firmly engaged in integrating a large portion of its output downstream to semifinished and finished products.

(e) In the other countries the picture is more complicated. Suriname's bauxite production was halved by 1987 compared to 1978 and essentially for this reason it is now able to refine all its output. The country's primary aluminium production fell to just 2,000 tons in 1987, recovering to 30,000 tons in 1988, this being the production capacity in the foreseable future.

(f) Jamaica and Guyana have also shown production cuts accross the industry and these cuts have been the only cause of their bauxite/alumina ratio changes. Guyana has ceased to be an alumina producer since 1983 and Jamaica has experienced larger reductions in mine output than in refining.

Table 16

Bauxite/alumina production ratios in Latin American and Caribbean countries

| | 1978 | 1987 |
|---|---|---|
| Brazil | 2.6 | 4.7 |
| Guyana | 16.0 | .. |
| Jamaica | 6.3 | 5.5 |
| Suriname | 4.1 | 1.9 |

Source: Tables A.3 and A.4 in the statistical annex.

Note: In 1987 Guyana had no processing capacity and Venezuela was still fully dependent on imported bauxite. It should also be noted that about half of Guyana's bauxite production is intended for non-metallurgical end uses.

Table 17

Latin American and Caribbean countries production gaps between bauxite, alumina and aluminium in 1978 and 1987

| | 1978 | | 1987 | |
|---|---|---|---|---|
| | Production capacity (thousand metric tons per year)a/ | Additional processing capacity required to treat the given input production | Production capacity (thousand metric tons per year)a/ | Additional processing capacity required to to treat the given input production |
| Bauxite | 30.112 | | 24.965 | |
| Alumina | 4.873 | 178% | 5.975 | 88% |
| Aluminium | 502 | 385% | 1.538 | 94% |

a/ Including capacity for production of non-metallurgical grade bauxite and alumina.

Source: 1978: Aluminium Conductor Development Corporation Survey of Planned Increases in World Bauxite, Alumina and Aluminium Capacities 1975-1983. London, 1978. 1987: UNCTAD secretariat

104 Considering the Latin American/Caribbean area as a whole it is seen that the region is essentially an alumina and bauxite supplier and to a lesser extent, owing to Brazilian exports after the 1970's, a primary metal source to the world market (see Table 18).

105. In Western Europe (not including Yugoslavia, since most of its exports go to socialist countries in Eastern Europe) dependence on imported bauxite increased, during the 1978 to 1987 period, since bauxite capacity fell by 17 per cent, while alumina capacity increased by 26 per cent. In 1978, for each ton of alumina produced in Western Europe, just under one ton of bauxite had to be imported. In 1987, the net import need had increased to 1.35 tons of bauxite for each ton of alumina. Despite the expansion of alumina capacity, involving two large projects (Aughinish in Ireland and San Ciprian in Spain, both with design capacities of 800,000 tons per year), and a very modest net increase of aluminium smelter capacity by about 25,000 tons per year, import needs for alumina were only marginally reduced, since during the same period, production of alumina for non-metallurgical purposes increased rapidly, absorbing most of the increase in alumina output. Primary aluminium production increased only slightly, while consumption grew at an average annual rate of 2 per cent. Thus, at the end of the period, Western Europe from being a net exporter of unwrought aluminium, had become a net importer.

106. In Asia, it is worth mentioning the case of Japan, where primary metal production has been reduced to almost nothing. Although it still retains a significant alumina production capacity (output over 700.000 tons in 1987) this has also been reduced during the decade. What is left is mainly for non-metallurgical uses but even those plants will be the subject of careful analysis in terms of their profitability during the coming years. Thus Japan has reversed its position and strategy in the aluminium industry as a consequence of the worsening of its competitive position after the early 1970's. Instead of seeking self-sufficiency in primary metal production it now looks for partnership in other countries.

107. In Africa, where Guinea is a major producer (second in the world), it should be noted that there is a huge gap between this country's bauxite production and its relatively small alumina output, representing just over 10 per cent of what could potentially be produced.

108. Australia, the main world producer of both bauxite and alumina, also exhibits a gap between bauxite and alumina production capacity. In 1978 for each ton of alumina output it produced an extra 1.36 ton of bauxite. In 1987 this relation had been decreased to 1.16 through higher alumina production capacity offsetting mainly the decreased refining capacity in the United States. With regard to aluminium in Australia, although the gap is much larger, it is worth emphasizing that it has been very much reduced from 24 tons of "surplus" alumina in 1978 to 8 tons in 1987 for each ton of primary metal.

109. Canada is known to be one of the lowest cost metal producers in the world, due essentially to the availability of cheap hydroelectricity. Canada is however historically dependent on imported inputs for its metal output. During the last decade it has kept a fairly stable alumina output which in 1978 was enough to supply more than half of its needs. In 1987, given the almost 50 per cent increase in metal output, the imported alumina requirements had grown proportionally.

110. The United States also increased its reliance on imported alumina during the 1978-87 period. Instead of 0.6 ton of imported alumina for each ton of metal produced it is now importing 0.8 ton. As the gap between alumina and aluminium capacity increased, there was also a tendency for the gap between primary aluminium capacity and fabricating capacity to grow, similarly to what happened to a greater or lesser extent in all major consuming countries.

## D. Exports of bauxite, alumina and aluminium from the Latin American/Caribbean area and intra-regional trade

111. Table 18 shows the shares of Latin America and Caribbean exports of bauxite, alumina and aluminium going to different regions (see also tables A.21 to A.25 in the statistical annex). The traditional dependence on the North American market is seen to have decreased somewhat at most stages, with Western Europe and Japan assuming greater importance as export destinations. For bauxite, exports have been diversified, with significant quantities now going to Western Europe and socialist countries (Jamaican exports to the USSR). The increase in intra-regional trade is expected to be a transitory phenomenon, since Brazilian exports to Venezuela are likely to diminish as the mine at Las Pijiguaos reaches full operating capacity. The patterns and volumes of alumina exports have remained relatively stable. As regards aluminium, total exports have increased rapidly, as have exports to all regions. The most striking increase has been in exports to Japan, where Latin American countries have managed to capture a significant portion of the market created by the closures of all but one Japanese smelter. Exports of semi-manufactured products have also increased rapidly, with the United States as the major market.15

Table 18
Destinations of exports of bauxite, alumina and aluminium from Latin America and the Caribbean in 1978 and 1987
(percentage shares)

| | Bauxite | | Alumina | | Unwrought aluminium | | Semi fabricated products | |
|---|---|---|---|---|---|---|---|---|
| | 78 | 87 | 78 | 87 | 78 | 87 | 78 | 87 |
| Latin America/ Caribbean | 0.7 | 25.1 | 2.8 | 3.0 | 13.4 | 5.9 | 66.9 | 25.0 |
| North America | 95.0 | 51.4 | 36.4 | 34.2 | 30.2 | 16.4 | 32.2 | 46.8 |
| Western Europe | 3.8 | 11.2 | 57.7 | 62.4 | 36.1 | 22.0 | 0.0 | 25.6 |
| Japan | 0.4 | 0.1 | 0.3 | 0.0 | 15.3 | 49.5 | 0.8 | 2.3 |
| Developing countries | 0.1 | 0.0 | 2.4 | 0.4 | 5.0 | 5.4 | 0.0 | 0.3 |
| Socialist countries | 0.0 | 12.2 | 0.4 | 0.0 | 0.0 | 0.9 | 0.0 | 0.0 |

Source: UNCTAD secretariat.

112. As seen from the tables in the statistical annex, intra-regional trade has remained of modest proportions. It is somewhat surprising that, while producers have succeeded in finding new export markets overseas (the reduced dependence on the North American market being largely forced on Latin American and Caribbean producers by falling North American demand and changes in the major companies' strategies as regards sources for their raw material supply), they have not been able to penetrate neighbouring country markets. There are of course several reasons for this, the main ones being:

(i) The limited size of most regional markets, both for less processed products, where countries such as Brazil and Venezuela have achieved near complete vertical integration, thereby leaving only a residual market for other Latin American/Caribbean countries, and for semi-manufactures and finished goods. Thus, even capturing a relatively large share of the market may not justify the necessary investment in marketing. Consequently, these markets are left to larger trading organizations, which are able to achieve economies of scale, to exploit.

(ii) The existence of long standing contractual relationships which, over the years, have proved satisfactory and where there is consequently little stimulus to change. Examples of this may be Argentina's and Mexico's imports of alumina from respectively Australia and the United States.

(iii) Transportation difficulties, arising from the lack of transportation routes through the interior of the South American continent and the absence of intensively trafficked shipping routes, add costs to intra-regional trade, in particular in terms of shipping time.

(iv) Time consuming foreign exchange and customs procedures are often cited by the industry as a factor which deters producers from trying to exploit regional markets.

(v) The existence of tariff and non-tariff barriers to trade in many countries in the region, which restrict imports (see chapter IV in the following).

(vi) Finally, and probably most important, the difficult financial situation faced by most countries in the region has necessitated cut-backs in imports of almost all goods. Since capital investment in many cases has been brought to a near standstill, several of aluminium's most important market segments have lost their dynamism. Furthermore, the tight financial situation has also led to a general shortage or absence of export credit, which obviously puts Latin American exporters in a weak competitive position.

## II. TECHNOLOGY AND COSTS OF PRODUCTION

### A. Processing technology

#### Introduction

113. The aim of this chapter is to review the present conditions of processing technology in the region through the various stages of production. When possible, the analysis is carried out on a country and company basis. It starts by briefly describing the most important basic characteristics of the processing technology thereby preparing the ground for the subsequent discussion.

#### Bauxite mining and treatment

114. Aluminium is the most abundant metal in the earth crust comprising more than eight per cent of its outer layers. As an industrial material aluminium is of recent usage compared with the other metals. It was discovered in 1825/1827 and the production processes were developed only towards the end of the 19th century. One of the reasons for this late development is that aluminium does not occur in the natural environment in metallic form, making it relatively more difficult to recognize.

115. The main source of economically extractable aluminium is bauxite, a heterogeneous material of earth-like appearance. Bauxite is the name given to the products of chemical weathering of aluminium rich rocks. Bauxite deposits can be classified into two main types according to the nature of their occurence and genesis:

(a) karstic bauxites associated with limestones, which are usually finer grained and tend to have a higher iron content.

(b) lateritic bauxites, which have an origin associated with aluminosilicate rocks and are usually much coarser grained.

116. The differing characteristics of these deposits which also vary within the same type of deposit are important since they determine the features of the mine operation and ore treatment.

117. Given the genesis of bauxite deposits (weathering of a parent rock) they usually lie at or close to the surface and as a consequence most bauxite mining is open pit. The mining of bauxite therefore usually requires stripping of an overburden which may vary from a thin top soil (as in Jamaica for instance) to a thick layer of sediments of 50 to 60 meters (as in Guyana). The stripping operations are carried out by draglines, scrapers, bucket wheel excavators, or hydraulicking. A thick overburden can obviously have a major impact on total mining costs. The ore is then extracted and loaded by means of shovels, draglines and scrapers, and haulage to the alumina plant or port facilities by trucks, rail road or conveyor follows. If the ore is hard it must be broken by blasting before extraction.

118. Bauxite treatment is usually restricted to crushing, washing to remove impurities and separate the fines, and drying. By washing and screening it is possible to remove sand and some of the clay minerals. Drying is carried out because in some cases it facilitates the handling characteristics of the ore (above a certain limit, say 15 per cent, moisture may cause clogging of conveyors or freezing in storage) and in others because it saves on freight costs since free moisture may range from 10 per cent to 30 per cent. Non-metallurgical bauxites (refractories and abrasives) are calcined to remove both free and chemically combined water. Drying usually reduces moisture content to 10 per cent for Caribbean bauxites and 5 per cent for other types16/. If the alumina plant is close to the mine site the bauxite is dried at that plant since use of the heat recovered from refining cuts drying costs to around 50 per cent.

119. Commercial grade bauxites usually require an alumina (Al203) content of at least 40 per cent. Some specially high grade ores may contain as much as 60 per cent of Al203. The alumina content of bauxites may include one or a combination of the following minerals:

- gibbsite (Al203 . 3H20)
- boehmite (Al203 . H20)
- diaspore (Al203 . H20)

If the deposit consists mainly of gibbsite with less than 3 per cent boehmite it is classified as trihydrate type. This is the lowest cost ore to refine since it requires lower temperature and pressure conditions. If the deposit consists mainly of boehmite it is classified as monohydrate type. This type requires much higher refining temperature and caustic concentration and for this reason is a more expensive ore to refine. Between both of them, in terms of refining costs, is the mixed type bauxite which contains gibbsite as the predominant mineral but which has a boehmite content of over 3 per cent.

120. The mineralogy of bauxite is extremely important since it determines refining costs. The following elements are particularly important:

(a) Silica ($SiO_2$) is one of the most serious contaminants because the reactive silica combines with alumina, forming an insoluble silicate, consuming caustic soda in the process. Silica present in quartz sand or chalcedony, however, is usually non-reactive and thus not important, but in high temperature processes fine grained quartz becomes reactive.

(b) Iron and titanium are insoluble but must be mechanically removed to prevent contamination of the alumina. Other common insoluble impurities are calcium, magnesium and manganese. The problem of insoluble impurities, besides requiring proper equipment to remove them is that, the higher their quantity the larger is the volume of mud generated during processing and consequently the higher is the cost of refining.

(c) Soluble impurities like chlorine, sulphate, and organic carbon above certain levels may require special treatment, the most direct one being a higher soda concentration during the digestion.

Alumina production 17/.

121. The technology generally used to produce alumina is the Bayer process, patented in 1888 and still the most economical means available. The basic ingredients are bauxite, caustic soda and lime. The alumina refining starts, in general, with a mixture of crude bauxite and heated caustic soda which is fed to ball or rod mills. Lime is added to reduce carbonates, regenerate caustic soda and control phosphorus content. The resulting slurry is pumped with additional soda to digestors where, at high pressure and temperature, the original alumina content of the ore is dissolved, forming soluble sodium aluminate, and a complex sodium aluminium silicate is precipitated.

122. As indicated above, bauxites of the tri-hydrate type require a lower digestion temperature (from 110o C to 150o C). This process is also called American Bayer process and is designed for bauxites from Guyana, Brazil, Suriname and West Australia for instance. The low temperature plants also require a lower caustic concentration (since the ore is more soluble) and require less capital investments compared with the European or high temperature process, designed to treat European monohydrate bauxites. The monohydrate ores require temperatures from 250o C to 290o C, and higher caustic concentration.

123. The industry has also developed what is known as the modified American Bayer process, designed for mixed types of bauxite (as in North Australia and some Jamaican deposits) for which caustic concentration and temperature are somewhere in between the two extremes (from 150o C to 240o C depending on the specific ore characteristics).

124. The insoluble impurities are separated from the sodium aluminate solution by filtration and settling forming the red mud. The red mud disposal is an important item in the cost of refining since it must not affect the natural environment.

125. The clarified sodium aluminated liquor is then seeded with fine crystals of alumina trihydrate causing the alumina hydrate to dissociate from the soda, precipitating as crystals. The caustic soda solution with remaining alumina in solution, is recycled to the digestors. The filtered and washed alumina hydrate then goes to the calciners where moisture is removed at very high temperatures (1150o C to 1250o C) and after which the alumina is ready for smelting. Until the early 1960's the most common type of calciners were the rotary kilns. Later they tended to be substituted for fluid bed calciners (stationary) which, although requiring more capital, save more than 30 per cent of fuel, and require less maintenance.

Primary metal production

126. Primary aluminium is produced by the Hall-Heroult process which like the Bayer process for alumina refining, dates from the end of the 19th century and to date is the only commercial technology used. In short this process consists of the reduction of alumina by electrolysis in a bath of cryolite (fluor salts) and aluminium fluoride. The reduction takes place in a series of pots or cells forming a potline. The pots consist of an outer iron shell with an inner carbon lining which operates as the cathode. There are two kinds of anodes currently in use. Both use carbon anodes produced from petroleum coke. The Soderberg anode uses green (unbaked) carbon paste which is held above the bath. Electric current flows through the anode and new paste is added as it is consumed. This method is not used in new smelters because of difficulties in collecting off-gases which are highly toxic because of fluorine contents. In the pre-baked anode system, prebaked carbon blocks are suspended above the molter bath. This method is more suitable to off gases collection and is also more energy efficient. The bath is kept at 945 C to 985 C (varying according to its chemical composition) and molten aluminium is removed from the pot every one or two days to be alloyed or shaped in various forms.

127. The reduction of alumina by electrosis is highly energy intensive. Reducing energy consumption has therefore been one of the main targets for research and development in the industry. The consumption of energy has been reduced from almost 20,000 Kwh/ton in the 1970's to 12.900 Kwh/ton in the most modern 280 kA Pechiney technology. Even though the average energy consumption per ton of aluminium is still much higher, since the number of new smelters is not large and among those many still use an older generation of technology, it has been possible to retrofit old plants and consequently lower their energy requirement.

128. With greater efficiency and automation over the years it has been possible to reduce also the labour input required per ton of aluminium. Again in regard to Pechiney's 280 kA technology it is said that compared with the 100 to 110 shift workers required for a 110 kA Soderberg plant, the Pechiney technology requires only 25 to 30 (on the basis of a 240,000 ton/year production).18/.

129. An idea of the rapidity with which research on smelting technology has progressed can be had from quoting a US Bureau of Mines Publication written in 198419/ : "Utilizing direct current, cells operate at 65,000 to 150,000 amperes; the majority of plants have 80,000 to 100,000-A cells. The larger cells require less labour ....., but special problems are encountered in cells designed to operate at 100,000 and more". As was just mentioned, Pechiney (and also Alcoa and Alcan) have technologies in the range of 280-275 kA.

## B. Latin American and Caribbean countries in an international perspective.

### Bauxite

130. Table 19 tries to assess the relative position of Latin American and Caribbean countries in an international context in terms of bauxite reserves and their competitiveness. As can be seen, only Australia and Guinea are important bauxite sources outside the Latin American/Caribbean region. Australia is especially competitive in Asia while Guinea is so in Europe. The main disadvantage of Guinean resources is that they are mostly of the mixed type (high monohydrate content). The European ore is essentially non-competitive on export markets since it is expensive to refine (monohydrate) and to extract (mostly underground).

131. Among the Latin American and Caribbean countries, Haiti and the Dominican Republic are distinguished for having only marginal bauxite reserves of the mixed type. As pointed out earlier, this was the reason for the closure of their mining operations.

132. The Brazilian ore from the north of the country has proved to be competitive in various markets. The disadvantage that could be pointed to is related to the reactive silica content which, nevertheless, is lower than those of Suriname and Guyana.

Table 19

Bauxite resources and characteristics

| Country/ Region | Reserve Base a/ (million tons) | Stripping Ratio | Type Bauxite & process | Alumina content % | Reactive SiO2 | Bauxite Alumina Ratio | Mud Generated per ton of alumina (in tons) | Distan to port or refiner (km) |
|---|---|---|---|---|---|---|---|---|
| BRAZIL | 2.621 | 1:1 b/ | Trihydrate (1% mono) low temperature | 54 | 3.5 | 2.1 | 0.7 c/ | 1.10 |
| GUYANA | 900 | 9:1 | Trihydrate (1% mono) low temperature | 57 | 4.0 | 2.0 | 0.5 | 225 |
| HAITI/ DOMINICAN REP. | 50 d/ | 0:1 | Mixed (10% to 15% monohydrate) high temperature | 48 | 3.0 to 4.5 | 2.4 | 1.2 | 25 |
| JAMAICA | 2.000 | 0:1 | Trihydrate (3% mono) low temperature | 46 e/ | 1.5 | 2.5 | 1.2 | 20 |
| SURINAME | 600 | 1:1 | Trihydrate (no mono) low temperature | 56 | 4.0 | 2.0 | 0.6 | -- |
| VENEZUELA | 350 | 0.05:1 | Trihydrate (no mono) low temperature | 50 | 2.2 | 2.2 | 0.8 | 600 |
| AUSTRALIA | 4.600 | 0.1:1 | Trihydrate (Western Austr.); mixed (Gove & Weipa) 2% to 12% boehmite | 53 | 1.5 to 4.5 | 2.2 to 3.3 | 1.0 to 1.5 | 30 to 145 |
| GUINEA | 5.900 | 0:1 | Mostly mixed (8% boehmite) some trihydrate | 58 to 60 | 1.5 | 2.2 | 0.8 | 130 to 320 |
| WESTERN EUROPE | 1.075 f/ | 3:1 | Monohydrate (30 to (but mostly 85% high temperature underground) | 52 to 56 | 3.5 to 6.0 | 2.2 | 1.0 to 1.2 | |

Source: World Bank Staff Working Papers, Nr. 603, 1983.
U.S. Bureau of Mines: Commodity Summaries, 1988
Interviews with industry and press material.

a/ USBM, Mineral Commodity Summaries, 1988. The Reserve Base Concept includes measured plus indicated reserves. Given that it embraces both economic and marginal reserves the chemical composition and other characteristics are not the same for all the reserve figure. An estimation of the Economic Reserve for 1981 is given in World Bank (1983).

b/ The stripping ratio varies according to the deposit. The figure given applies to the main producer MRN.

c/ On a dry basis. In the consumption of wet bauxite for the domestic market this figure can be more than one.

d/ From World Bank, 1983.

e/ Because of relatively higher monohydrate content Jamaican bauxite presents a somewhat lower recoverable alumina content (around 35%) since the low temperature process is not able to recover it.

f/ Includes Greece, Yugoslavia and France.

133. The Guyanese bauxite has a very high alumina content, which makes it an important source of refractory grade bauxite. The mining operations are costly, however, owing to the thick overburden, the hardness of the ore which requires blasting, wet mining sites which require pumping, and shallow rivers.

134. Jamaica also possesses good quality reserves which are easily extracted. On the other hand the alumina content is relatively low, which explains the high rate of mud generation per ton of alumina. Another factor which may adversely affect ore refining is its fineness.

135. The bauxite reserves in Suriname are of good quality, the only adverse characteristic being their relatively high silica content.

136. Venezuelan deposits are still at the development stage and will be exploited mainly for the domestic market (Interalumina). Although the development is costly owing to the lack of infrastructure, the country expects its output to be cost competitive in comparison with the imported ore. Brazilian and Venezuelan deposits are the most distant from port or refinery compared with other major sources which adds an important cost element to their refining.

## Alumina

137. Table 20 shows that most major Latin American and Caribbean countries use the low temperature process which, as seen above, is the lower cost technology. The high temperature process tends to be used mainly in older European and American refineries tied to monohydrate bauxite sources, but which also accept trihydrate bauxites.

138. As pointed out earlier, all modern refineries use the stationary fluid-bed calciners technology as opposed to the older rotary kilns for the calcination stage. Nevertheless many of the plants built originally with rotary kilns can adopt a series of measures to retrofit (or in other words, reform) their calciners so that their performance becomes more competitive with the newer technology. This was the case with Jamalcan of Jamaica20/. Others still can choose to substitute their kilns by newer ones as has been the case with Alcoa in both Suriname and Jamaica. In both alternatives the objective is to improve the energy efficiency of the plant. In Brazil, with the exception of the new Alumar refinery, the refineries are still in need of modernization programs. In Venezuela, Interalumina already uses the modern stationary technology.

Table 20
Alumina production - technology indicators in selected countries

| | Process | Calciner | Energy source | Total energy (Gj/ton) | Labour productivity (hour/ton of alumina) |
|---|---|---|---|---|---|
| BRAZIL | low temp. | rotary (a) | oil (a) | 14.5 | 2.4 |
| JAMAICA | low temp. | rotary (Alcan & Alpart) stationary (Alcoa) | oil | 13.5 (b) | 1.7 (c) |
| SURINAME | low temp. | stationary | oil | 12.1 | 2.0 |
| VENEZUELA | low temp. | stationary | gas | 11.5 | 1.7 |
| AUSTRALIA | low temp.(d) | stationary (e) | mainly gas but also oil and coal | 11.5 13.5 | 1.0 |
| YUGOSLAVIA | high temp. | rotary | oil | 15.5 | 2.0 |
| GERMANY | low temp. high temp | rotary & stationary | coal and | 13.0 14.0 | 1.0 |
| UNITED STATES | high temp.(f) | rotary & stationary | gas | 13.5 | 1.0 |
| CANADA | low temp | stationary | gas | 14.0 | 1.3 |

(a) Only the new Alcoa/Billiton (Alumar Refinery) has a stationary kiln and uses coal for steam generation. Its energy requirement is also lower than average (GJ 11.5/t).
(b) GJ 11.5/t for Alcoa.
(c) Does not include Alpart which is not operating.
(d) Except the QAL refinery.
(e) Except QAL and Gove.
(f) Except Ormet's refinery.
Source: Interviews and trade journals.

139. The main energy source for alumina refining in the Latin American/Caribbean region is oil. The exception is Venezuela which because of easy availability uses natural gas, the most economic source of energy. In other regions and countries the source of energy depends on local availability. As a general rule, natural gas would be preferred when available.

140. The last two columns in table 20 are interesting since they give an idea of the performance and efficiency of the various countries included. The two poorest performances (in terms of energy consumption per ton of alumina and labour productivity) are those of Brazil (with the exception of the new Alumar project) and Yugoslavia. In the case of Brazil, the figures measure the efficiency of the older plants located in the South east of the country which are fed by nearby deposits. They include plants owned by Alcoa, Alcan and CBA which were originally built as part of integrated operations intended for the domestic market. The incentives to modernize these refineries may be lacking due to the protection of the domestic market or to the offsetting effect of other cost items in an international perspective. Another remark that can be made is related to the overall lower labour productivity of Latin American and Caribbean producers compared with Americans, Europeans and Australians. It is worth emphasizing that even Venezuela with its very efficient and modern plant presents a low performance compared with the best practice.

Table 21

Primary metal technology: Latin American, Caribbean and selected countries

| | Technology | Production in 1987 (thousand) metric tons) | Energy type & consumption per ton of Al (MWh) | Start-ing | Labour[a] | Labour productivity (ton/man/year) |
|---|---|---|---|---|---|---|
| ARGENTINA | Prebaked | 155 | hydro/15.9 | 1975 | 1250 | 125 |
| BRAZIL | | | | | | |
| Alcan (Sar) | Hor.Stud.Sod | 54 | hydro/17.6 | 1945 | 1000 | 54 |
| Alcan (Aratu) | Vertical Sod. converted to Sumitomo | 58 | hydro/17.0 | 1972 | 850 | 68 |
| Alcoa (Pocos) | Vertical Sod. | 90 | hydro/16.8 | 1970 | 1000 | 90 |
| CBA | Vertical Sod. | 169 | hydro/17.0 | 1954 | 1300 | 130 |
| Valesul | Prebaked, Reynolds 160 kA | 91 | hydro/15.1 | 1982 | 830 | 110 |
| Alumar | Prebaked/180-200 kA | 241 | hydro/14.3 | 1984 | 1400 | 172 |
| Albras | Prebaked (Mitsui/Pechiney b/ | 166 | hydro/15.4 | 1985 | 1400 | 118 |
| MEXICO | Vertical Sod/Alcoa | 67 | hydro/k coal 17.3 | 1963 | 580 | 115 |
| SURINAM | Vertical sod/Alcoa | 30 | hydro/17.6 | 1965 | 470 | 64 |
| VENEZUELA | | | | | | |
| Alcasa | Prebaked/Reynolds c/ | 139 | hydro/17.6 | 1967 | 1300 | 107 |
| Venalum | Reynolds 161 kA d/ | 300 | hydro/15.0 | 1978 | 2650 | 113 |
| GREECE | | | | | | |
| Pechiney | Prebaked | 126 | hydro/14.1 | 1969 | 1200 | 105 |
| NORWAY | | | | | | |
| Hydro | Prebaked/Pechiney(175kA) | 90 | hydro/13.75 | 1982 | 350 | 257 |
| AUSTRALIA | | | | | | |
| Alcan | Prebaked e/ | 154 | thermal coal/15.90 | 1969 | 1100 | 140 |
| Comalco | Prebaked/Sumitomo | 208 | termal coal/15.30 | 1982 | 920 | 226 |
| Gove | Prebaked/Pechiney 175KA | 240 | termal coal/14.10 | 1983 | 860 | 279 |
| CANADA Alcan | Vertical & Hor Sod. & Prebaked f/ | 404 | hydro/19.0 | 1925 | 2500 | 162 |
| USA | Prebaked/Alcoa - 190 KA | 185 | thermal coal/24.35 | 1980 | 700 | 264 |

Sources: Annual Reports, interviews and specialised press.

a/ Includes supervision.

b/ Phase two 150 kA.

c/ Expansion of 180000 t with Pechiney 280 kA.

d/ Amperage increased from the original 150 kA technology. Fifth potline (118,000t) under construction with Hydro Aluminium 240 kA technology.

e/ 2 pot lines at 150/160 kA, 1 at 175 kA.

f/ 100000t scheduled to close as the new Laterriere smelter enters into production.

141. Since the technology and even the operating companies are to a great extent the same worldwide, one would have to seek the factors behind this poor performance in the local countries of operation. Possible reasons could be, among others:

(a) comparative over- employment due to much lower labour costs and, in the case of state companies, political reasons.

(b) specific difficulties in the process of technology adaptation.

(c) lower level of training (owing for instance, among other reasons, to larger turn over of employees).

Smelting

142. In regard to smelting technology, the area which has attracted most of the research and development effort is related to energy efficiency and cost reduction since, as pointed out earlier, these factors have been the main driving forces in the industry restructuring.

143. In terms of energy efficiency one of the more readily available indicators is the amperage of the potline which has been increasing steadily. The prebaked anode technology is also more energy efficient compared with the Soderberg.

144. Some of the older smelters use more than one technology because expansion investments usually adopt the latest vintages of technology. Others are modernized in some aspects to become more competitive although retaining the original basic concept. From table 21 it is possible to see that the newer smelters show a smaller energy consumption.

Table 22

Learning process in aluminium production: The case of Venalum in Venezuela

| | 1983 | 1984 | 1985 | 1986 | 1987 | Designed Capacity |
|---|---|---|---|---|---|---|
| Energy Consumption (MWh/ton Al.) | 16.0 | 15.55 | 14.84 | 14.87 | 15.04 | 14.44 |
| Amperage | 146 | 148 | 152 | 156 | 161 | 150 |
| Cell productivity (Kg/cell day) | 1,048 | 1,068 | 1,089 | 1,133 | 1,165 | 1,075 |
| Labour productivity (man-hour/ton) | -- | 11.69 | 10.34 | 10.45 | 9.64 | -- |

Source: Venalum's Annual Reports.

145. In Brazil for instance, Alcoa's and Billiton's Alumar project is the most efficient and modern in the country, followed by Valesul and Albras which operate with a relatively lower amperage. Although Albras is as recent as Alumar it adopted a somewhat older technology because this was the technology of its Japanese partner which made the implementation easier and cheaper. Valesul (CVRD and Billiton) which started in 1982 can also be considered a modern smelter as can be seen by its low energy consumption figure. In fact its Reynolds potline technology was first commercially used in 1974. The other older smelters all use the Soderberg technology and because of that are less energy efficient, with electricity consumption at around 17.0 MWh per ton of metal produced. One case worth stressing and already touched upon is the case of CBA, the only private Brazilian smelter, not only because of its relatively early entry into the aluminium industry in an international perspective, but also because of its approach to technology transfer. It has never accepted the payment of royalities or partnership but only acquisition on a "once and for all" basis. This explains its original sources of technology, first Elkem from Norway, followed by Montecatini from Italy and more recently Pechiney.

146. The two Venezuelan smelters are relatively modern, with Venalum ranking among the most efficient in the region together with Alumar in Brazil. Venalum is also a good illustration of the learning process in the aluminium industry in Latin American and the Caribbean as can be seen from table 22, which shows its performance after 1983 when it was given a new managing team.

147. Because many of its aluminium smelters are under construction or in the planning phase, Venezuela should in the future become one of the most efficient producers. At least three of the new smelters have adopted the new Pechiney technology with an amperage of 295/300 kA and an expected energy consumption of 14 MWh per ton of metal or even lower.

148. Argentina's smelter (Aluar) can be ranked as an average producer in terms of energy efficiency consuming about 16.0 MWh per ton of aluminium.

149. Mexico's and Suriname's smelters are somewhat older (started up during the earlier 1960's) and for this reason they rank among the least efficient in terms of energy consumption together with the older Brazilian smelters and Alcasa of Venezuela.

150. On an international basis the picture is somewhat similar but with the extremes more pronounced. It is possible to find smelters consuming as much as 19.0 MWh per ton of aluminium (Alcan's Arvida smelter in Canada) or as little as 13.75 MWh (one of Hydro Aluminium's smelters in Norway).

151. These extremes can be explained by the shorter lead time between research and developmemt and commercial production and by the greater cost pressure in the case of the most efficient, and by the very low cost of energy (Alcan in Canada) in the case of the least efficient. As can be seen from the figures, the newer Latin American smelters have energy efficiencies similar to those in developed countries for similar vintages of technology.

152. However, the situation is not the same in the case of labour productivity. Although the indicator available is very crude 21/ it does indicate that the Latin American smelters are still far from the "best practice" in terms of labour producitvity. Obviously this more than two fold difference of productivity in some cases is off-set by the much lower labour costs in developing countries. This issue will be discussed in detail in the next chapter.

## B. Costs of production

### Bauxite

153. As the previous chapter indicated, bauxite mining is a relatively easy and low cost operation compared with mining of hard rocks, for instance. This is so mainly because bauxite deposits are usually at or near the surface. For this reason the cost of mining in many cases accounts for less than 1 per cent of the total costs of aluminium production.

154. A comprehensive survey of bauxite mining costs worldwide has been carried out by the U.S. Bureau of Mines. 22/. Although the study is based on 1980/81 data, mining costs today can be adequately inferred by adjusting the original figures for the U.S. dollar inflation. Additionally, and as important, the breakdown of cost components is relatively stable in terms of their respective shares. The results obtained were:

| | |
|---|---|
| Labour | 27 to 32% |
| Fuel oil | 8 to 9% |
| Diesel fuel, lubricants and tires | 15 to 19% |
| Maintenance | 21 to 27% |
| Miscellaneous | 18 to 21% |

155. In Brazil costs were estimated to vary from US$4.20 to US$ 7.0 per ton, which corresponds to US$ to US$ 5.05 to US$ 8.5 per ton in 1987 dollar terms. The low end probably refers to the mines in the southeast as opposed to the other extreme which refers to the Trombetas region in the north. In Guyana the costs are estimated to be US$ 7.80 to US$ 10.0 and in Jamaica US$ 4.8 to US$ 6.0 (both in 1987 value). In Australia mining operating costs can vary from US$ 3.5 to US$ 8.0 per ton (1987 values) and in Guinea the cost could range from as low as US$ 0.6 to US$ 13.5. A more complete picture from that study is given in table 23 where a weighted average of cost figures is presented for selected countries.

Table 23
Operating costs of bauxite production
(1987 US dollars per ton)

| Country | Mine and mill | Transportation to port or refinery | Levy or severance tax-1987a | Total cost at port or local refinery | Export price |
|---|---|---|---|---|---|
| Brazil | 6.8 | 5.0 | 1.0 | 12.8 | 26.68 |
| Guyana | 9.3 | 1.5 | -- | 10.8 | 23.0 |
| Jamaica | 6.7 | 1.0 | 12b/ | 17.7 | 26.0 |
| Suriname | 10.1 | 2.6- c/ | 12.7 | 26.0 | |
| Venezuela | 6.0 | 9.3 | - | 15.3 | -- |
| Australia | 5.4 | 1.4 | 0.50d/ | 7.3 | 14.50 |
| Guinea | 6.5 | 7.9 | 6.0e/ | 20.4 | 27.50 |

Source: U.S. Bureau of Mines: Aluminium Availability, 1983 except for the last column which is based on international trade figures, press material and interviews.
Note: Original cost figures have been adjusted for inflation, according to the US wholesale price index.

(a) Updated according to information gathered.

(b) The base levy is estimated to have been around US$20/ton of bauxite. But owing to the existence of incentives for capacity utilization and foreign exchange generation the effective levy is abut half.

(c) Dropped the levy system in 1987. When applicable the effective levy used to be somewhat lower than the Jamaican although the original formula was similar.

(d) The figure is estimated average effective royalty which varies among the provinces.

(e) The effective levy in Guinea has been halved in 1987 compared with previous years.

156. Venezuela's operation will be a low cost one but will be faced with important transportation costs to the port. Suriname illustrates the opposite case, low transportation cost coupled with comparatively high production cost. Another important cost element to add to the operating cost to derive the total cost, besides transportation, is the taxation system which varies from country to country. As observed earlier the levy system was the means chosen by the Caribbean countries to participate in the revenues generated by the exports of the industry. In these countries then, this was a particularly important cost component in the total cost figure. More recently, amidst the restructuring process of the aluminium industry, these countries have had to renegotiate their levy systems, lowering and in some cases abolishing them.

157. In Jamaica, the leading country in the introduction of the levy, the rate was reduced to 6.0 per cent in 1984 from the 6.5 per cent prevailing after 1978 and against an original rate of 7.5 per cent in 1974. In 1988, the levy was again cut to 3.0 per cent, and at the same time a 33.3 per cent tax on profits was introduced.

158. Suriname, which followed the Jamaican initiative imposing a levy rate of 6.0 per cent in 1974, replaced the levy system with an ordinary income tax in 1987.

159. The other country where the levy has been important, Guinea, has also renegotiated its levy system in order to give more emphasis to profit taxation. It seems that in 1988 the levy system will be abandoned.

160. As is clear from the preceding review the levy system is becoming less and less common, giving place to taxation of profits,. In that approach the selling price becomes more important and so does the accounting system of the producer companies. The cost of production of a given bauxite may then not be so important for determining its competitiveness as the base price or minimum export price authorized by the host government when that is the case. Establishing a minimum price is not an easy task, since more than 75 per cent of bauxite consumption is traded between related parties and the greatest proportion of it by the six major producers. An idea of the realized export price in 1987 is obtained from the last column of table 23.

Alumina

161. With regard to alumina the main cost items are bauxite, energy and labour. The cost of other raw materials is also often of importance, in particular since caustic soda prices rose drastically in 1988. The proportion of each of these items in the total operating costs varies from country to country basically in response to the availability of energy and bauxite.

162. Table 24 gives a summary of cost data for the main countries including those in the latin American/Caribbean region. It should be emphasized that these data do not include capital charges which are in some cases very important, especially for newer plants. As can be seen from the data the Latin American and Caribbean countries are competitive producers. A common cost advantage of the region is the lower labour costs. The low cost figure for Brazil should be taken with caution, since its expansion potential is in the North and, the cost of production there will be substantially higher since bauxite will be an expensive item. In Jamaica, bauxite and energy are the main cost items. Energy is especially problematical since the country has no domestic energy resources. Suriname's problem lies in its general eocnomic and social situation which has contributed to increase its bauxite costs as the Moengo mine was temporarily closed and ore had to be imported. Venezuela has a potential to rank among the lowest cost producers due to the availability of the cheapest energy among the producing countries. So far the main item is bauxite which this country still imports. With the start up of the mine at Los Pijiguaos it will be possible to reduce alumina production costs by around 10 per cent. Finally, caustic soda generally has to be imported by Latin American and Caribbean alumina producers. The cost of this item has increased dramatically lately.

Table 24
Alumina cost of production (US$/ton of alumina

| | Canada | USA | Brazil | Jamaica | Suriname | Venezuela | Australia | France |
|---|---|---|---|---|---|---|---|---|
| Raw materials | | | | | | | | |
| Bauxite | 72 | 62 | 18a/ | 40 | 40 | 70 | 16 | 65 |
| Other | 18 | 15 | 20 | 15 | 20 | 22 | 20 | 18 |
| Energy | 30 | 36 | 34 | 46 | 32 | 10 | 30 | 60 |
| Labour | 40 | 42 | 28 | 32 | 34 | 28 | 36 | 40 |
| TOTAL | 160 | 155 | 100b/ | 133 | 126 | 130 | 102 | 183 |

Source: Trade journals and interviews.

Notes:

a/ Alumar's bauxite costs (Alcoa/Billiton) are much higher because the bauxite is bought from MRN. The figure is probably US$ 60./ton of alumina.

b/ Total operating costs for Alumar are probably similar to USA's total less the difference in labour costs.

163. Comparing with countries outside the region it can be inferred that European producers have very high costs. In addition to the generally high labour costs, common to all developed countries, energy is more than twice as expensive in Europe as in most other producing countries. In the case of France,the high costs have forced closure of two refineries since 1984 and have led to an increasing concentration on production of non-metallurgical, higher priced, alumina at the remaining one. Canada, and the United States, although also ranking as high cost producers, have the ability to remain competitive because most of their plants have low capital charges. It should be stressed, however, that in both countries the alumina output covers just part of their domestic consumption (one third and two thirds, respectively).

Primary aluminium

164. As was seen earlier, refining and smelting technologies have remained largely unchanged since the beginning of the industry. As a result there is a great deal of similarity in the production process worlwide. There is thus a tendency for the costs of production to be homogeneous across countries although the level of development of a particular country (labour costs, level of industrialization, etc), energy availability, and economic policy are key determinants of the differences in production costs. Table 25 gives an indication of the costs of production worldwide. As can be seen the key variables are the price or cost of alumina, energy and labour.

165. Energy has for long been the key input of aluminium smelting because of its inelasticity of supply and the high costs of new generating capacity. With the closure of much of the smelting capacity in the United States, Europe and Japan, the remaining smelters have been able to negotiate more favourable long-term energy supply contracts, often with energy prices linked to the aluminium prices. Several smelters in Australia, northern Brazil, Canada, the United States and Europe have contracts of this form.

166. Alumina is mostly traded between different parts of the same company (around 70 per cent of the total consumption) although many firms adopt a "market" value for the alumina for accounting purposes. In any case, prices of both the intra-firm alumina and the alumina traded between unrelated parties are influenced by the price and market situation of the primary metal. Other raw materials include petroleum coke for the production of anodes and cryolite.

Table 25
Primary aluminium costs of production
(1987 US$ per ton of aluminium)

| | Raw material (of which, alumina) | Energy | Labour | Other | Total operating cost |
|---|---|---|---|---|---|
| Argentina | 430 (320) | 105 | 60 | 75 | 670 |
| Brazil | | | | | |
| Saramenha | 360 (250) | 380 | 110 | 110 | 960 |
| Aratu | 370 (260) | 370 | 115 | 90 | 945 |
| Pocos | 365 (260) | 395 | 75 | 120 | 955 |
| CBA | 335 (230) | 290 | 60 | 90 | 775 |
| Valesul | 465 (360) | 380 | 65 | 90 | 1000 |
| Alumar | 420 (330) | 290 | 45 | 80 | 835 |
| Albras | 420 (330) | 230 | 80 | 70 | 800 |
| Mexico | 425 (320) | 380 | 42 | 68 | 915 |
| Suriname | 390 (280) | 110 | 160 | 140 | 800 |
| Venezuela | | | | | |
| Venalum & Alcasa | 430 (320) | 120 | 60 | 70 | 680 |
| Greece | | | | | |
| (Pechiney) | 405 (290) | 310 | 120 | 85 | 820 |
| Norway | | | | | |
| (Hydro Aluminium) | 480 (280) | 150 | 130 | 90 | 850 |
| Australia | | | | | |
| (Alcan) Kurri | | | | | |
| Kurri | 370 (270) | 235 | 185 | 90 | 880 |
| (Gove) | 400 (310) | 260 | 95 | 110 | 865 |
| Canada | 440 (350) | 80 | 200 | 120 | 840 |
| USA | 380 (290) | 490 | 145 | 100 | 1115 |

Source: Industry reports and interviews.

167. As for labour costs there are two distinct factors to be taken into account. First, there is the difference in costs between developed and less developed countries which may correspond to a factor of five. Second, there is the difference in labour costs among developing countries or even within a single country owing basically to differences in labour requirement of different vintages of technology (for instance, the Soderberg anode smelters in Brazil have a much higher unit labour cost than the pre-baked ones).

168. Again, as in the case of alumina it should be stressed that the cost figures in table 25 do not include depreciation and other capital charges.

169. The most competitive smelters operated with costs below US$900 in 1987. Nevertheless, even the high cost smelters, with costs just above the US$ 1000 level, were able to show a profit at the prevailing 1987 prices of primary metal. In fact the high level of prices that year provided the incentive to reopen some of the smelters in the United States, many of which had been closed for two years or more.

170. In the Latin American/Caribbean region, Argentina and Venezuela rank as low cost producers. However, as seen earlier there is not much potential for expansion in Argentina, owing to restricted availability of hydroelectric energy. On the other hand the low cost of production in Venezuela, based mainly on cheap energy, has been playing an important role in attracting the interest of the main international producers.

171. In Brazil the picture is more heterogeneous because of the different ages of the smelters. In general the south eastern smelters are higher cost producers because they are older, their technologies are less efficient and their energy supply prices are less favourable than those of smelters in the north. The higher price of energy in the southeast is the reason that the relatively modern Valesul smelter has a high production cost, besides the fact that it relies on outside supplies of alumina. CBA, although also located in the southeast, is one of the lowest cost producers in the world, mainly because it generates 50 per cent of its energy requirements. In the north, due to the policy of attracting new investments, the government has approved special electricity tariffs for the aluminium industry.

172. Mexico and Suriname have only one smelter each and no plans for major expansions. In both countries lack of cheap energy is the main hindrance. In both Mexico and Brazil the cost of energy is seen as a potential threat to the expansion and even survival of the industry. Especially in Brazil, which was earlier considered as one of the best loci for new investment in aluminium smelting, the cost of new dams in the Amazon has proved to require higher electricity prices than anticipated.

## D. Investment requirements in the aluminium industry

173. The aluminium industry is very capital intensive. The capital costs of major investment projects are related to factors such as: 23/

- access to site
- regional topography
- environmental legislation
- availability of infrasturucture and competitive energy supply
- climate
- availability of skilled labour and costs
- industrial relations
- access to materials
- source of technology
- import duties

The factors which affect the total investment cost are so varied and may be so country specific that each country or even each project may have a unique cost picture. Nevertheless, some generalizations are possible and they do play a role in the decision making strategies of companies.

Mining

174. The investment cost in mining is affected by the factors mentioned above as well as by the nature of the deposits which may require different equipment and processing according to their characteristics.

175. The Brazilian mine of Mineracao Rio do Norte (MRN) in the Amazon, for instance, has absorbed to date around US$ 500 million. It now has a capacity of 6 million tons per year compared with the original 3.35 million. The amount spent includes all infrastructure required by the project, such as port and local town, and was spent over a ten year period (1978/1988). On the average, it meant an investment of more than US$ 80/ton of capacity.

176. Bauxiven, the Venezuelan mine, is also a high cost project having a capital cost of approximately US$ 150 per ton or even higher. Capital costs in Jamaica and Guyana, according to historical figures, have been lower per unit of output, mainly because of relatively easier access to the mining sites and hence smaller infrastructural requirements. Figures would vary from US$ 45 to US$ 75 per ton of output.24/

177. It is obviously cheaper to expand an existing mine than to invest in a green field operation since a good proportion of the existing infrastructure can be adapted to a higher productive capacity. In this way MRN in Brazil, for instance, can be increased to 8 million tons per year from the present 6 million tons with relatively minor investment. The existance of potential mining capacity such as those of MRN and, in the near future, Bauxiven in Venezuela, may even preclude new investment decisions from taking place. A case in point is Alcoa in Brazil which, although holding good bauxite reserves, has counted on MRN for a cheaper supply.

Refining

178. Refining is relatively more capital intensive than mining. Investment costs vary, however, with the kind of bauxite to be treated. As mentioned above (see section A of this chapter) the monohydrate bauxites require a high temperature process which involves at least a five per cent increase in capital cost compared with the low temperature process.

179. New alumina refining projects cost from US$ 700 to US$ 800 per ton of annual capacity according to recent estimates for the Alunorte project in Brazil. It should be noted, however, that Alunorte is located near a large city (Belem) which reduces the costs of infrastructure, labor and materials compared to what they would be if the refining was to be located close to the mine in Trombetas. At Inter-alumina in Venezuela, unit capital cost has been estimated to reach US$ 1000 or higher.25/ The capital cost for a refining plant in developed countries (North America, Europe and Australia) may be a little smaller (10 to 15%) based on possible advantages related to the general factors listed above. Again, as in the case of mining, expansion projects have lower capital costs than new projects. The magnitude involved varies with the specific project under consideration and in particular with the amount of "anticipated" investment included in the initial project. In any case, the cost of expansion projects may vary from US$ 400 to US$ 500 per ton.

Smelting

18C. Recent estimates of capital costs of new aluminium smelters are around US$ 4,000 per ton of annual capacity. Examples of new projects include:

| Company/Country | Capacity (T/Year) | Capital cost (in US$)/ ton annual capacity |
|---|---|---|
| Al...s I/Brazil | 160,000 | 4,700 |
| Aluyana/Venezuela | 195,000 | 4,500 |
| Pechiney/France | 194,000 | 3,900 |
| Alamsa/Venezuela | 180,000 | 3,500 |
| Alugur/Venezuela | 120,000 | 3,125 |
| Laterrieri I(Alcan)/Canada | 60,000 | 3,000 |
| Alouette (VAW)/Canada | 278,000 | 3,000 |

181. Most new smelter projects are planned and constructed in two or three phases. The first phase usually includes the necessary buildings and equipment for auxiliary services of the whole project which makes green field projects relatively more expensive than expansions. Albras II, for instance, will have a capital cost of US$ 3,800/ton compared with US$ 4,700 of the first phase. The Alumar (Alcoa/Billiton) expansion, also in Brazil, on the other hand, will cost Billiton only US$ 1,800 per ton of output. On average US$ 3,000 per ton of annual output can be considered the average cost of expansion projects.

Capital requirements

182. Taking into consideration planned projects all stages of the industry (see tables 8 and 13 in Chapter I), and considering the capital cost estimates given above for both green field and expansion projects, it is possible to infer that up to 1993 Venezuela will need to invest 2.2 billion dollars and Brazil about US$ 1.8 billion.

183. It is worth emphasizing that in the case of Brazil the investments include the completion of Alunorte which will require US$ 500 million in addition to the initial investment already made, Albras' second phase which is already under way and which will require US$ 650 million, Alcan-Aratu with a US$ 90 million expansion program, the expansion of Alumar which will require US$ 245 million for the smelter plus US$ 45 million for the refinery, CBA's expansion with a total cost of US$ 300 million for smelting, power station and for alumina refinery. It should be noted that these investment programmes do not include and do not require an expansion in bauxite mining since MRN will be able to provide the bulk of the increased demand by directing its sales to the domestic market.

184. In the case of Venezuela, the total capital requirement for the next five years until 1993 includes: the duplication of Bauxiven in a US$ 240 million project; the expansion of Interalumina in a US$ 750 million investment; Venalum's expansion - US$ 620 million; Alisa first phase smelter - US$ 270 million; and Alusur smelter - US$ 375 million. If the time horizon is extended to 1995, the total investment requirements will reach about US$ 3 billion.

185. For the other countries of the region the investment requirements are linked essentially to modernization plans. it is projected that Jamaica, Guyana and Suriname will not increase their mining production capacity although Guyana, for instance, will require a relatively higher expenditure in the near future to keep output constant. In terms of refining Guyana will need at least an estimated US$ 30 million dollars investment to reopen the Linden plant. The Alpart refinery in Jamaica would also require modernization.

## III DEVELOPMENT OF DEMAND AND SUPPLY UNTIL THE MID-1990s

### A. The global economic environment

186. The rate of global economic growth is obviously going to be a major decisive factor for the development of future aluminium demand. At the moment, however, there is little agreement on the question of likely future growth rates, one reason for this being the present very large imbalances in the major industrial economies, in particular the current account deficit of the United States and the payments surpluses of the Federal Republic of Germany and Japan, as well as uncertainty about the form which adjustment will take and the speed with which it will be accomplished. Growth rates in these major developed economies affect the economic prospects of developing countries, not only because they absorb a very large porportion of developing country exports, including exports of bauxite, alumina and aluminium, but also because the prospect for arriving at a resolution of the external debt crisis facing many developing countries will be improved if economic growth in the major industrialized countries continues and the present imbalances are eliminated.

187. While the macro-economic policies of the major developed countries at present seem to be focussed mainly on containing the rate of inflation and thus not very conducive to rapid growth, there also seems to be several arguments in favour of continued stable growth. In many industrial countries labour and capital are still underutilized, and there would thus be no capacity brakes on economic expansion. The benefits of the economic integration processes in developed countries and of potential trade liberalization arising from the Uruguay Round of multilateral trade negotiations could also be expected to translate into a higher rate of economic growth than would otherwise be possible to achieve.

188. Table 26 sets out some assumptions about economic growth rates prepared by the World Bank. They are reproduced here as background to the demand projections discussed in section C of this chapter, which are based on World Bank projections using this set of assumptions.

189. The future development of demand for aluminium depends not only on the rate of general economic growth, but also on the composition of that growth. While aluminium demand during the early post-war period increased faster than economic growth or growth in industrial production, the reverse was the case in industrialized countries after the early 1970's. Thus, intensity of use of aluminium relative to both GDP and industrial production fell in these countries. In developing countries, however, the intensity of use measured by consumption per unit of GDP at constant prices, has continued to increase.

Table 26

Assumptions on the growth of real GDP/GNP

(average annual rate of change in per cent)

| | 1973-80 | 1980-87 | 1987-90 | 1990-2000 |
|---|---|---|---|---|
| DEVELOPED MARKET ECONOMY COUNTRIES | 2.4 | 2.5 | 2.6 | 3.0 |
| France | 2.8 | | | 2.5 |
| Germany, Federal Republic | 2.3 | | | 2.6 |
| Japan | 3.7 | | | 3.7 |
| United Kingdom | 1.0 | | | 2.1 |
| United States | 2.2 | | | 3.0 |
| DEVELOPING COUNTRIES a/ | 5.3 | 4.0 | 4.5 | 4.9 |

a/ 90-country sample

Source: World Bank: Price Prospects for Major Primary Commodities, Report No. 814/88.

190. Developed countries still account, however, for the major share of aluminium consumption, one reason being that aluminium use is strongly correlated to level of income. Table 27 and Figure 1 attempt to illustrate this. In table 27, consumption of primary aluminium and of semi-manufactured products per capita is shown for a number of countries. Figure 1 shows consumption of semi-manufactured aluminium products per capita on one axis and GDP per capita on the other.

Table 27
Aluminium consumption per capita in selected countries in 1978 and 1987 (kilograms per person)

| | Primary aluminium consumption | | Apparent consumption of semi-manufactured products a/ | |
|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 |
| DEVELOPED MARKET ECONOMY COUNTRIES | | | | |
| Australia | 12.8 | 19.2 | 14.5 | 18.8 |
| Canada | 14.4 | 16.4 | 20.4 | 23.8 |
| France | 10.0 | 11.1 | 9.8 | 13.8 |
| Germany, Federal Republic | 15.5 | 19.4 | 19.5 | 26.9 |
| Italy | 7.2 | 9.6 | 11.1 | 17.5 |
| Japan | 14.4 | 14.3 | 17.3 | 19.6 |
| Spain | 6.4 | 7.0 | 7.5 | 8.7 |
| United Kingdom | 7.2 | 6.7 | 12.0 | 11.5 |
| United States | 22.4 | 18.6 | 29.3 | 27.3 |
| SOCIALIST COUNTRIES | | | | |
| Czechoslovakia | 8.7 | 7.0 | | |
| German Democratic Republic | 13.4 | 13.3 | | |
| USSR | 7.0 | 6.4 | | |
| DEVELOPING COUNTRIES | | | | |
| Argentina | 2.2 | 4.5 | 2.5 | 4.5 |
| Brazil | 2.1 | 3.0 | 2.5 | 3.2 |
| Cameroon | 2.9 | 2.3 | 2.3b/ | 1.9b/ |
| Colombia | 0.7 | 0.8 | 0.8b/ | 1.1b/ |
| India | 0.3 | 0.4 | 0.3b/ | 0.5b/ |
| Mexico | 1.3 | 0.8 | 1.8 | 1.4 |
| Peru | 0.2 | 0.3 | 0.3b/ | 0.4b/ |
| Republic of Korea | 2.9 | 4.9 | 3.4 | 5.7 |
| Saudi Arabia | 0.1 | 1.4 | 2.8b/ | 4.3b/ |
| Venezuela | 4.9 | 7.9 | 7.2 | 5.7 |

Source: UNCTAD secretariat.

a/ Defined as consumption of primary and secondary metal plus imports of semi-manufactured products minus exports of semi-manufactured products.

b/ Not including secondary consumption.

## B. Developments in major end-use sectors

191. Aluminium is used in a multitude of applications in all sectors of the economy. In contrast to the situation for other metals, demand for aluminium therefore does not depend on events within one or two narrow end-uses, and it can be assumed to be more resistant to technological change. On the other hand, only in some relatively small sectors is aluminium protected from substitution in the sense that its technical advantages are so large that relative prices play a subordinate role. Indeed, aluminium is subject to strong competition from potential substitutes in almost all market segments and high relative prices for aluminium would reduce its competitiveness significantly in most applications.

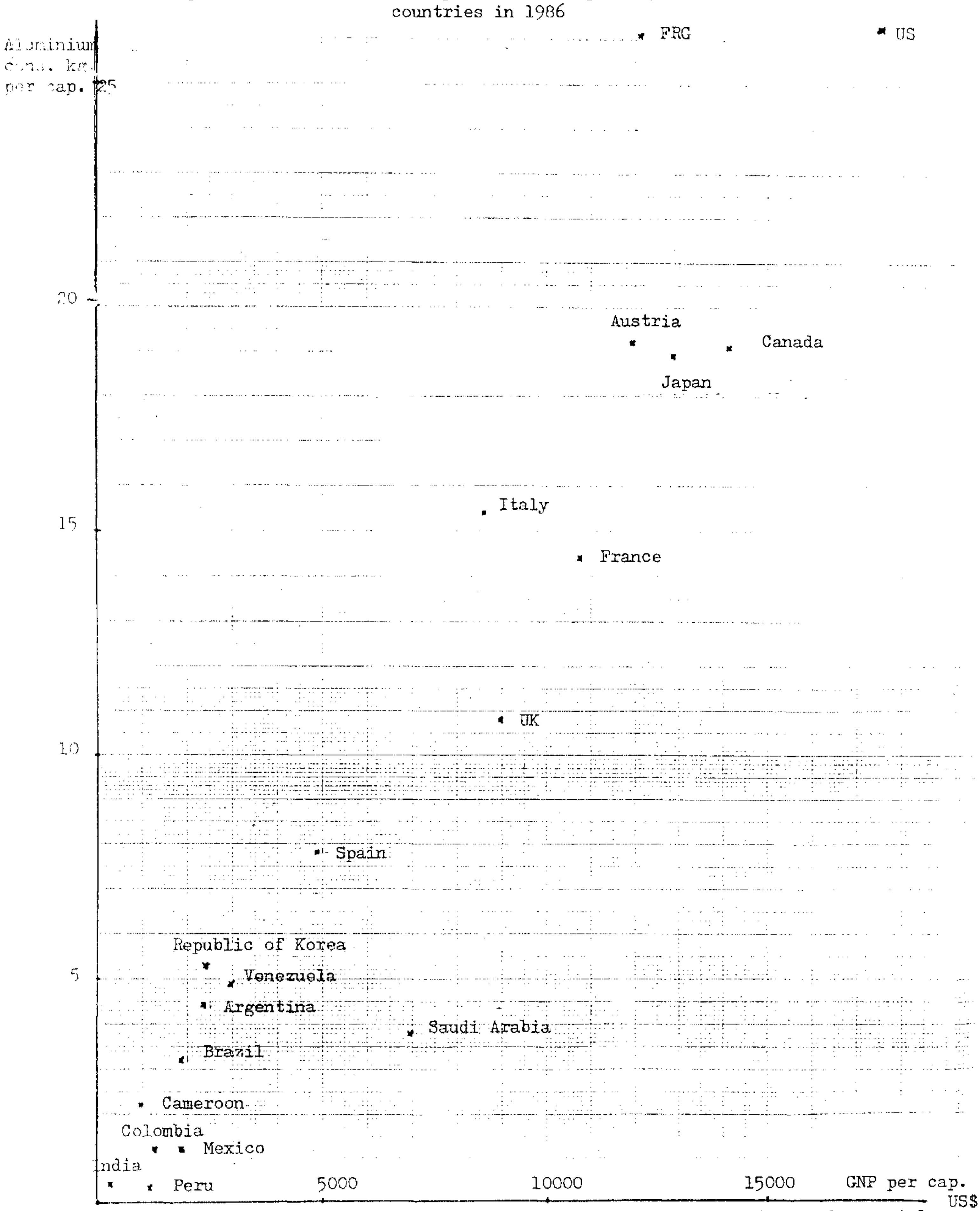
192. Major aluminium producers have traditionally emphasized research and development, in particular the development of new products, to stimulate aluminium demand. Annaul research and development budgets for some of the large companies are well in excess of 100 million US dollars.26/ The research and development activities of these companies can at present be classified into three broad categories, including work aimed at reducing production costs, development of new alloys and production processes for specific end-uses, and general materials research. The last two categories have assumed increasing importance as user specifications have become more stringent, necessitating the "tailoring" of materials to specific end-uses. This tendency carries certain risks for developing country producers since they often lack the close contacts with final consumers as well as the technological know-how to be competitive in these highly specialized markets. Thus, a two-tier industry could develop, with developing country producers supplying bulk products, while the more profitable specialty products would be produced exclusively by developed country producers.

193. Another aspect to be taken into account when analyzing developments in end-uses is that the composition of aluminium demand varies considerably from one country to another. As was shown in table 3 in Chapter I, the share of aluminium consumption in 1987 going to packaging, for instance, was 7.8 per cent in Japan and 30.1 per cent in the United States. A large share of consumption is thus determined by local tradition and consumer preferences. Since these preferences are subject to change in the long-term, forecasting consumption in any given end use is difficult. In the following, trends in major end uses are nevertheless reviewed in an attempt to identify future prospects for demand.

### Transport

194. The transport sector accounts for a large part of aluminium consumption - over 20 per cent in major industrialized countries. Consumption within this sector has also increased more rapidly than total aluminium consumption. Underlying this trend is both an above-average performance of the transport sector itself, compared to other industries, and increasing usage of aluminium in the tranport industry, particularly the automobile industry.

Figure 1: Aluminium consumption and GNP per capita in selected countries in 1986




Note: Maximum consumption is defined as consumption of primary and secondary metal plus imports of semi-manufactured products minus exports of semi-manufactured products. For Cameroon, Colombia, India, Peru and Saudi Arabia, secondary metal consumption is not included.

Source: UNCTAD secretariat.

195. While in the early 1980's about 4 per cent of the material used in automobile manufacture was aluminium 27/ the proportion is now approaching 10 per cent28/. To a large extent, aluminium has been able to increase its share because of its favourable strength to weight ratio. There are several ongoing development projects aiming to increase dramatically the amount of aluminium used, by building the space frame of the car in aluminium instead of steel. In most cases, these projects use plastic materials for the covering of the space frames. While aluminium is more expensive than steel, savings could be made in the production process, either by using extruded aluminium for the spaceframe, rather than stamped sheet29/ or by using adhesive bonding techniques, thus reducing the number of welding spots30/ Additional advantages accrue from the improved fuel economy of the car due to the lower weight, and from savings on corrosion protection. In body cover parts, where aluminium would have the same advantages over steel, competition from plastics is expected to be strong. Aluminium has one advantage over plastics, however, since it is easily recyclable, whereas recycling of plastic body panels may be both technically difficult and pose environmental risks.

196. In aircraft, where titanium has replaced aluminium to some extent in military aircraft, aluminium has recently also faced strong competition from composite materials, including resins and plastics. Such composite materials have replaced aluminium in many parts of military aircraft since, although their costs are higher, they are lighter and have equal strength characteristics. Because of their high prices, these materials have not yet found wide application in commercial aircraft 31/ As techniques for producing components of resin or plastic based composites develop, however, they may partly replace aluminium in this market segment as well. To counter this trend, aluminium producers have developed aluminium based composites, which have fibres of silicon carbide, alumina or boron carbide in an aluminium matrix, as well as aluminium-lithium alloys. These materials would allow savings in the weight of the aircraft, leading to lower fuel consumption. While the aluminium-lithium alloys are less expensive than the aluminium based composites, they still have significantly higher costs of production than traditional aluminium aircraft alloys. They are also more difficult to recycle, which could prove to be a major disadvantage, since material losses in machining can be very high, ranging for instance, for sheet products from 7 to 84 per cent32/

197. Aluminium use in other transport sectors, such as buses, trucks and railroad cars, is generally increasing, in particular for body panels.

198. In summary, use of aluminium in the transport sector could be reasonably expected to continue to grow at a rate slightly higher than that of the sector's output. It should be stressed, however, that given the attention that is paid to the choice of materials in this sector and the amount of research and development under way, major changes could occur quite rapidly and with little warning to aluminium producers.

Mechnical engineering

199. This sector accounts for a relatively small share of aluminium consumption, less than 10 per cent in most countries. While consumption, according to available data, appears to have been increasing at a slightly higher rate than total aluminium consumption (see table 3 in chapter I), it is difficult to identify any applications where the development has been especially dynamic in this very heterogeneous sector. Because of the wide range of products and the diversity of materials used, it is also difficult to isolate any areas that are clearly critical to aluminium consumption. Consequently, no definite assumptions concerning the direction of change can be made.

Electrical engineering

200. The share of total aluminium consumption accounted for by the electrical engineering sector has fallen over the last decade, although it remains significant, at just under 10 per cent. Two trends appear to account for most of the slowing down of the rate of growth: substitution and downsizing in the electronics industry, and reduced investment in electricity transmission networks, resulting from slower growth in demand for electricity and non-availability of investment funds, in particular in developing countries. It is not likely that the first trend will be reversed in the foreseable future. Investment in electricity transmission, which can be seen as a relatively "safe" market for aluminium, will depend in particular on the availability of funds for infrastructural investment. In summary, consumption within this sector is unlikely to show strong growth over the next few years.

Building and construction

201. The use of aluminium in this sector varies greatly from country to country according to local traditions and tastes. Aluminium is used mainly in the form of extruded shapes for doors and windows, etc., but also in the form of sheet or plate for building siding, in particular for industrial buildings. It is difficult to discern a clear trend in consumption, although table 28 appears to show that aluminium use in construction has increased in several countries during the last decade. On the other hand, in the countries where it was used most intensively, i.e., Japan and the United States, the use has declined. Another observation that can be made from the table is that aluminium was relatively intensively used in Argentina and Brazil. Use of aluminium in construction thus appears not to be confined to developed countries.

Table 28

Consumption of aluminium in building and construction in selected countries in 1978 and 1986

| | Consumption in construction in per cent of total consumption a/ | | Consumption in kilograms per thousand US$ of construction sector activity b/ | |
|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 |
| DEVELOPED MARKET ECONOMY COUNTRIES | | | | |
| France | 10.2 | 11.3c/ | 1.17 | 1.50c/ |
| Germany, Federal Republic | 16.2 | 15.4 | 2.85 | 3.31 |
| Italy | 21.0 | 23.9 | 4.29 | 4.86 |
| Japan | 34.3 | 29.6 | 5.26 | 4.74 |
| Spain | 24.6 | 29.2 d/ | 3.68 | 4.69d/ |
| United Kingdom | 13.0 | 18.9 d/ | 2.22 | 2.44d/ |
| United States | 23.0 | 21.9 | 9.33 | 7.88 |
| LATIN AMERICAN COUNTRIES | | | | |
| Argentina | 18 | 24 d/ | 2.81 | 4.92d/ |
| Brazil | 20.3 | 18.2 d/ | 4.73 | 4.32d/ |
| Mexico | 4.6 | 8.8 | 0.85 | 1.40 |

Sources: Aluminium consumption in construction: Metal Statistics, Metallgesellshaft, Frankfurt a.M., ALUAR (Argentina); Anuario Estatistico ABAL 1987 (Brazil); Estadisticas 1987, Instituto Mexicano del Aluminio (Mexico). Construction sector activity: Statistical Bulletin of the OAS (Argentina); U.N. Statistical Yearbook and UN Monthly Bulletin of Statistics. Price indices and exchange rates: IMF International Financial Statistics.

a/ Domestic consumption defined as domestic shipments of semi-manufactured products, except in the case of Argentina and Mexico where imported semi-manufactures are included.

b/ In 1986 dollars, deflated by wholesale price index or nearest equivalent, and converted at 1986 average exchange rates.

c/ Figures for 1984.

d/ Figures for 1985.

202. The large variations evidenced by table 28 could indicate that there is significant potential for increasing the use of aluminium in construction in many countries. This would be so, in particular, considering the advantages of aluminium with regard to lightness and ease of handling, the minimal need of maintenance and the wide range of surface finishes that can be easily obtained. Whether this potential will be realized, however, depends not only on relative price developments, where the current high price levels and large apptitude of price fluctuations may prove an obstacle, but also on promotion efforts of producers, including strict quality control. The cyclical nature of the construction industry in most countries may deter producers from becoming too dependent on this market.

Packaging

203. As table 29 shows, consumption of aluminium in packaging has generally grown at least at the same rate as aluminium consumption in general. There are, however, marked differences among countries, reflecting the degree to which aluminium has been able to penetrate local packaging markets. The most important difference is for beverage containers, where aluminium cans have achieved a nearly complete dominance in the United States market, but where competition from glass, plastic or tinplate cans remains strong in most other countries. While aluminium cans had over 90 per cent of the market for beverage cans in the United States in 1987, they accounted for about 50 per cent in Western Europe and 20 per cent in Japan.33/ The difference is likely to be due both to differences in the intensity of market promotion efforts on the part of aluminium producers, and on varying resistance on the part of local interests such as national steel industries. The use of aluminium in beverage cans is however increasing sharply in most countries. In Japan, demand for aluminium cans increased by 57 per cent in the 1987 fiscal year alone, and has continued to increase since.34/

Table 29

Consumption a/ of aluminium in packaging in 1978 and 1987 in selected countries

| | Per cent of consumption | | Kilograms per capita | |
|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 |
| DEVELOPED MARKET ECONOMY COUNTRIES | | | | |
| France | 9.5 | 8.3 | 0.94 | 0.83 |
| Germany, Federal Republic | 10.4 | 10.0 | 1.53 | 1.76 |
| Italy | 10.8 | 10.8 | 1.08 | 1.57 |
| Japan | 6.8 | 7.8 | 1.19 | 1.83 |
| Spain | 9.8 | 17.5 | 0.66 | 1.26 |
| United Kingdom | 10.8 | 14.2 | 0.87 | 1.00 |
| United States | 23.0 | 30.1 | 6.40 | 8.42 |
| LATIN AMERICAN COUNTRIES | | | | |
| Argentina | 16 | 16 | 0.34 | 0.40 |
| Brazil | 7.7 | 8.3 | 0.21 | 0.24 |
| Mexico | 12.7 | 21.6 | 0.24 | 0.28 |

a/ Domestic shipments of semi-manufactured products, except for Latin American countries where imported semi-manufactured products are included.

Sources: ALUAR (Argentina); Anuario Estatistico ABAL 1987 (Brazil); Estadisticas 1987, Instituto Mexicano del Aluminio (Mexico); Metal Statistis, Metallgesellshaft, Frankfurt a. M. (developed market economy countries).

204. The competitiveness of the aluminium can vis- -vis the tinplate can re..'s on low manufacturing costs and recyclability. According to a recent study35/, although the metal cost for 1000 cans is US dollars 27.54 for aluminium and 21.11 for tinplate (based on prices of US dollars 1.15 and 0.29 per pound, respectively), total costs, including corporate charges and ..pital costs are US dollars 69.13 for aluminium and 66.90 for tinplate, sin.. aluminium has a cost advantage of US dollars 3.57 in manufacturing. Recycling gives aluminium a benefit of US dollars 3.39 per 1000 cans (at 50 per cent United States recycling rates), leaving it with a cost advantage of US dollars 1.16, or almost 2 per cent. It should be noted that the cost differential was in aluminium's favour even at the historically high price of US dollars 1.15 per pound of canstock (at the high ingot prices prevailing in 1988, this price was however not sufficient to cover processing charges). While this cost differential may not be sufficiently large to provide incentive for a continued replacement of steel by aluminium, it is likely to prevent a switch back to tinplate by can manufacturers now using aluminium, taking into account high conversion costs.

205. As already mentioned, the recyclability of aluminium cans provides a further competitive advantage. Recycling rates appear to be on a generally increasing trend. In the United States, the recycling rate is estimated to have increased from 50.5 per cent in 1987 to 56 per cent in 198836/ and in countries with mandatory deposit laws, as for instance in Sweden, it has reached more than 80 per cent37/. While producers of tinplate cans are now developing technology and programmes for recycling of these cans, it appears unlikely that aluminium will lose this advantage over the next few years to come.

206. Aluminium cans are also becoming stronger competitors to tinplate cans in the food packaging sector. While this market segment is generally estimated to be smaller than that of beverage cans (about 28 billion units38/ per year in the United States, compared to between 72 and 74 billion units for beverages39/ it is believed that aluminium's share of it could be considerably increased. In 1985, aluminium cans had 5.7 per cent of the United States market for food cans40/ . Problems to be overcome include the need to produce cans in several different sizes, the necessity to use thicker and/or differently alloyed canstock to achieve sufficient rigidity of the can, and a perceived unwillingness of consumers to collect cans for recycling in the same amounts that is being done for beverage cans. Nevertheless, the food packaging sector may provide some opportunity for growth in aluminium consumption.

207. In summary, although consumption in the packaging sector will depend on the relative price developments of aluminium and tinplate as well as the results of market promotion efforts, it appears that this sector will at least not lose in importance and might very well continue the strong expansion shown in recent years.

### Other sectors

208. Other market segments than the ones reviewed in the foregoing account for relatively small and stable shares of consumption. No definite trends in end uses can be identified, given the diversity of applications, involving both household items and goods for industrial consumption as in the iron and steel industry. Consequently, no definite assumptions can be made regarding future growth rates, although it can be assumed that aluminium consumption in many of those uses is sensitive to relative price changes.

C. Expected global supply and demand situation in the mid-1990s

209. The world Bank41/ has prepared projections of future global demand for aluminium. These projections are summarized in table 30. The macro-economic assumptions underlying the projects are those shown in table 27. In addition, the Bank has made certain assumptions regarding developments within particular end-use sectors. These assumptions are similar to the assessments made in section B of this chapter, although it should be noted that the Bank foresees a more moderate consumption growth in the construction sector, where substitution of other materials for aluminium is seen as a risk. The Bank sees the relatively strong growth from 1982 to 1987 as basically a cyclical phenomenon, stimulated by rapid growth in capital goods industries, and considers it unlikely that the growth rate in these industries will remain at the same level.

Table 30

Projections of demand for primary aluminium in the period 1987 to 2000 (thousand metric tons and growth rates in per cent per year)a/

| | 1987 | 1990 | 1995 | 2000 | Growth rates 1987-1995 | 1987-2000 |
|---|---|---|---|---|---|---|
| Industrial countries | 11076 | 11004 | 11912 | 12821 | 0.9 | 1.1 |
| North America | 4958 | 4830 | 5120 | 5410 | 0.4 | 0.7 |
| United States | 4536 | 4520 | 4770 | 5020 | 0.6 | 0.8 |
| EEC-10 | 3415 | 3330 | 3680 | 4030 | 0.9 | 1.3 |
| France | 616 | 602 | 666 | 730 | 1.0 | 1.3 |
| Germany, Fed., Rep. | 1186 | 1195 | 1340 | 1486 | 1.5 | 1.7 |
| United Kingdom | 384 | 375 | 405 | 435 | 0.7 | 1.0 |
| Other Western Europe | 516 | 500 | 545 | 590 | 0.7 | 1.0 |
| Japan | 1750 | 1980 | 2165 | 2350 | 2.7 | 2.3 |
| Non-market | 2642 | 2810 | 3125 | 3440 | 2.1 | 2.1 |
| USSR | 1800 | 1915 | 2107 | 2300 | 2.0 | 1.9 |
| Eastern Europe | 842 | 895 | 1018 | 1140 | 2.4 | 2.4 |
| Developing countriesb/ | 3483 | 3640 | 4333 | 5040 | 2.8 | 2.9 |
| Asia | 2203 | 2110 | 2530 | 2050 | 1.7 | 2.3 |
| America | 851 | 828 | 990 | 1153 | 1.9 | 2.4 |
| World | 17201 | 17454 | | 21300 | 1.5 | 1.7 |

Source: Demand in 1987: UNCTAD secretariat. Projections: World Bank: Price Prospects for Major Primary Commodities Report No. 814/88.

a/ The World Bank classification of countries into regional groups does not in all cases coincide with the one used by UNCTAD.

b/ Including Greece, Israel, Portugal and Yugoslavia as well as socialist countries in Asia

210. World primary aluminium consumption is projected by the World Bank to grow at an annual rate of 1.5 per cent from 1987 to 1995 (if socialist countries are excluded, the annual growth rate drops to 1.4 per cent). It should be noted, that the World Bank is assuming that recycling of aluminium will increase as a proportion of consumption, which, in view of the fact that end-use sectors with a high proportion of recyclable materials have either grown relatively fast in recent years (for instance, transport), or are expected to show high rates of growth in the future (for instance, packaging), appears likely. In the absence of alternative projections, the following analysis uses the World Bank demand projection as a basis, although from a

historical point of view it may appear relatively low, and may be more likely to err on the conservative side than on the other. This is so in particular in view of the fact that the World Bank projections are based on an estimate of 1987 consumption which is about 100,000 tons lower than actual consumption, and which obviously cannot either take into account the continued strong growth in consumption in 1988.42/.

21' Table 31 shows expected changes in production capacity for bauxite, alumina and aluminium in non-socialist countries until 1995 (see also table A.26 to A.29 in the annex). The reason for excluding socialist countries is that reliable data on production capacities in these countries are not easily available. As the tables show, the major portion of capacity expansion until 1995 is expected to take place in developing countries, and in particular in the Latin American/Caribbean area. The planned integrated expansion of the Venezuela industry accounts for a large share, but Brazilian projects also make a major contribution to capacity growth.

Table 31

Production capacity for bauxite, alumina and primary aluminium in non-socialist countries in 1987 and until 1995

(thousand metric tons gross weight per year)

| | End 1987 | Changes from 1987 to 1995a/ | |
|---|---|---|---|
| | | Probable | Possible |
| Alumina grade bauxite | | | |
| Developed market economy countries | 44310 | +450 | +450 |
| Developing countries | 50665 | +12915 | +23115 |
| Africa | 16400 | +1500 | +1500 |
| America | 24265 | +11315 | +20915 |
| Asia | 6400 | +100 | +700 |
| Europe | 3600 | - | - |
| Total | 94975 | +13365 | +23565 |
| Aluminab/ | | | |
| Developed market economy countries | 19380 (2710) | +2285 (+605) | +2285 (+605) |
| Developing countries | 8985 (305) | +3685 (+30) | +6235 ( +30) |
| Africa | 700 (-) | - | - |
| America | 5975 (185) | +3125 ( - ) | +5675 ( - ) |
| Asia | 1040 (70) | +700 (+30) | 700 (+ 30) |
| Europe | 1270 (50) | -140 ( - ) | -140 ( - ) |
| Total | 28365 (3015) | +5970 (+635) | +8520 (+635) |
| Aluminium | | | |
| Developed market economy countries | 10409 | +933 | +2280 |
| Developing countries | 3464 | +2027 | +3702 |
| Africa | 463 | - | +120 |
| America | 1538 | +1255 | +2305 |
| Asia | 1090 | +728 | +1233 |
| Europe | 373 | +44 | +44 |
| Total | 13873 | +2960 | +5982 |

a/ Probable changes include expansion projects already realized as well as projects which are under construction, or where financing has been arranged. Possible changes also include other expansion projects that would be possible to realize until 1995.

b/ Metallurgical grade alumina. Figures within parentheses refer to production capacity for non-metallurgical grade alumina.

Source: UNCTAD secretariat

212. Another observation that can be made on the basis of the tables is that industrialized countries' share of world capacity is expected to continue its declining trend. With the expection of energy rich countries such as Australia, Canada, Iceland and Norway, the only new smelter project that is likely to be realized in these countries is the Dunkirk smelter in France, which constitutes a relatively small capacity addition since its opening is planned to coincide with the closure of two older, smaller smelters. In these case of alumina, the only new refinery project is the Hellenia Alumina refinery in Greece, the entire production of which is expected to be exported to the USSR. Other additions to capacity consist of additions to existing refineries. As for bauxite, the only capacity increase foreseen is the expansion of production capacity in the bauxite mines of Alcoa of Australia.

213. It is thus expected that the trends already observed during the 1970s and 1980s, that is, location of alumina refineries close to bauxite mines and of aluminium smelters in areas where low-cost energy is available, will continue into the 1990s. It should be stressed, however, that plans for capacity changes will be revised during the period until 1995. Depending on the direction of movements in prices and costs, including exchange rate changes, projects may be either postponed or brought into operation earlier than foreseen. Furthermore, one component of the future pattern of production capacity, namely possible closures, is as of yet largely unknown. Plants in the United States and in Western Europe are likely to be particularly sensitive to adverse changes in prices or costs.

214. Table 32 attempts to show the balance of supply and demand for primary aluminium, alumina and bauxite in 1987 and 1995. From the table, it appears that the "probable" capacity changes would be sufficient to cover non-socialist demand in 1995. Given the relatively high implied rates of capacity utilization it would also appear that most of these projects would be assured of a market. In addition, it should be noted that even a slightly higher rate of growth in consumption, for instance, 2 per cent per year instead of 1.4, would put the implied capacity utilization rate for smelters at 93.2 per cent, a rate which, judging from past experience, would be difficult to attain globally. There might therefore be room also for some of the projects in the "possible" category.

## D. Demand and supply in Latin America and the Caribbean

215. From the estimates of future global supply and demand made in section C of this chapter, the Latin American/Caribbean region as a whole would further confirm its status as a major exporter to the rest of the world at all stages of production, while aluminium consumption in the region itself would remain modest compared to capacity. It should be noted, however, that the projection of aluminium consumption is essentially a forecast of semi-manufactured production. Given the large amount of unused capacity in this sector in the region, projected aluminium consumption may well be exceeded, and the projection should, in any case, not be considered as certain. The possibilities of increasing production of semi-manufactures will be addressed in following chapters. They would appear to depend, however, on the prospects both of increasing exports to markets outside the region and of increasing sales within the region itself, either through import substitution or through increased regional consumption.

216. It is nevertheless clear that, even with rapidly growing regional consumption, the Latin American/Caribbean bauxite/alumina/aluminium industry will remain essentially export oriented. Based on the projections, and using the "probable" alternative for capacity changes, the exportable surplus of primary aluminium would be in the order of 1.8 million tons per year, or 65 per cent of production capacity. For alumina, the surplus would be about 3.5 million tons, or just under 40 per cent of capacity, while for bauxite the surplus would be almost 15 million tons, corresponding to about 40 per cent of capacity. Consequently, the industry will have to remain internationally competitive at all stages of production to ensure its continued survival and it will have a strong interest in the future development of the world market.

## IV. OPPORTUNITIES FOR AND CONSTRAINTS ON INCREASED LATIN AMERICAN AND CARIBBEAN PRODUDCTION

### A. Exports to areas outside the region

217. Table 33 represents an attempt to establish structural regional supply and demand balances for the years 1987 and 1995. The balances are based on historical and expected production capacities at different stages of production, except in the case of primary aluminium demand where, given the difficulty of obtaining reliable data on capacities in the semi-manufactured sector, historical and projected (according to the World Bank) consumption has been used. It should be noted that the balances for aluminium are therefore not comparable to the ones for bauxite and alumina, where consumption is assumed to equal capacity at the next stage. For socialist countries, actual and projected net trade with the rest of the world has been used.

218. Latin American and Caribbean exporters of bauxite are expected to see little change in their competitive position. Although demand for bauxiteimports is expected to increase in North America and Western Europe, African producers, in particular Guinea, are also well positioned to take advantage of the situation. Net exports from Asia are expected to decrease, mainly as a result of increased bauxite demand in India.

219. As regards alumina, demand for imports in Western Europe is projected to increase. Furthermore, a new alumina refinery in Greece with a production capacity of 600,000 tons per year has been included in Western European supply. Since the entire production of this refinery is planned to be exported to the USSR, import needs in Western Europe may be considerably understated, and could be the case also with socialist countries in Eastern Europe. Western Europe may therefore remain an attractive market for Latin American and Caribbean exporters in the future. A large increase in imports is also projected for Asia as a result of the establishment of new smelters in the Arabian peninsula. From the point of view of transport costs, it would appear, however, that Australian producers are in a better position to supply these smelters with alumina. Finally, the import needs of China, which have been provisionally set to zero, can only be guessed at, since they depend on the degree of success with which the present ambitious plans for expanding the Chinese bauxite/alumina/aluminium industry in a balanced way can be implemented. Should refinery construction fall behind the establishment of smelters, something which is possible considering the longer lead time for construction of refineries, or should China prefer to import alumina rather than make the costly investment in refineries, then Chinese import needs could be very large 43/.

Table 32

Supply and demand balance for bauxite, alumina and primary aluminium in non-socialist countries in 1987 and 1995 (thousand metric tons gross weight)

| | 1987 | 1995 Probable capacity change | 1995 Possible capacity change |
|---|---|---|---|
| Consumption of primary aluminium in non-socialist countries | 13697 | 15259 | 15259 |
| Net trade with socialist countries a/ | -179 | -187 | -187 |
| Change in stocks | -463 | 0 | 0 |
| Demand | 13055 | 15072 | 15072 |
| Production capacity | 13873 | 17224 | 19961 |
| (Implied) capacity utilization | 94.1% | 87.5% | 75.5% |
| Alumina consumption b/ | 26110 | 30144 | 30144 |
| Net trade with socialist countries a/ | +604 | +244 | +244 |
| Demand | 26714 | 30388 | 30388 |
| Production capacity | 28365 | 34335 | 36885 |
| (Implied) capacity utilization | 94.2% | 88.5% | 82.4% |
| Bauxite consumption c/ | 77295 | 88498 | 88498 |
| Net trade with socialist countries a/ | +5565 | +5665 | +5665 |
| Demand | 82860 | 94163 | 94163 |
| Production capacity | 94975 | 107940 | 118140 |
| (Implied) capacity utilization | 87.2% | 87.2% | 79.7% |

Sources: Data for 1987 (except stocks) and for production capacities in 1995: UNCTAD secretariat. Change in stocks: International Primary Aluminium Institutes London. Projections for consumption and trade in 1995: WorldBank, op cit.

a/ - Means net imports from socialist countries, + means net exports.

b/ - Demand for primary aluminium multiplied by 2.

c/ - Demand for alumina (including non-metallurgical grade) multiplied by 2.6 (average bauxite/alumina ratio according to IBA Quarterly Review, January-March 1989).

220. In aluminium, Japan is expected to remain the most important market, with import needs exeeding 2 million tons per year. Although Australia could be expected to remain the main supplier to Japan, there may be scope for expansion of Latin American exports44/. At the same time, it should be noted that Japanese import practices are changing. While spot purchases are estimated to have accounted for 46 per cent of supplies in 1988, with production shares in offshore projects and long-term contracts providing a further 26 per cent each, the share of the latter avenues of supply is expected to increase in the future.45/ While Venezuela's exports to Japan for the main part take place under a long-term agreement between Venalum and its Japanese part owners, Brazilian exports to Japan predominantly consist of sales on the spot market. What strategy to adopt by Latin American exporters will have to be decided carefully, in the light of, inter alia, the general development of the global market.

221. Since import needs are projected to increase in Western Europe, this market may be able to absorb a part of the increasing Latin American output, in particular since the exportable surplus from North America is projected to increase by a smaller amount.

222. The possible import needs of socialist countries are difficult to project. While the countries of Eastern Europe are likely to preserve their position as net exporters, the prospects of China eliminating import needs hinge on the success with which the present capacity expansion plans in this country can be implemented.

223. As regards barriers to trade, the exports of the Latin American and Caribbean aluminium industry are subject to relatively limited tariff and non-tariff and measures in its main markets in developed market economy countries. Where positive tariff rates exist, GSP rates are generally zero (although in the case of Japan there are limits to the quantities that can be imported under the GSP rate46/. While bauxite imported from developing countries is not subject to tariffs in any developed market economy country, tariffs on imports of alumina are levied by Japan, the European Economic Community and Australia. The European Community also charges a duty on imports of unwrought aluminium, as does Austria and Switzerland. The tariff rates in these cases are generally low. Tariffs, sometimes up to 25 per cent, are also imposed on a variety of semi-manufactures and finished products of aluminium, notably by Canada, New Zealand, Australia, Austria, and, in the case of foil, by the European Economic Community. Table 34 summarizes tariff rates for a number of developed market economy countries.

224. On the other hand, tariffs are generally higher in developing countries, where a large portion of the future consumption increase is expected to take place. Trade preferences among developing countries may, to some extent, alleviate this difficulty.

225. Transport costs for bauxite and alumina to regions outside the Western hemisphere are generally quite high, and although other exporters in Australia and Africa may also have high transport costs, their bauxite is often of higher quality, in particular in comparison to Jamaican bauxite, and these producers consequently have a degree of advantage when exporting to Europe or Asia.

Table 33

Regional supply and demand balances for alumina grade bauxite, metallurgical grade alumina and primary aluminium 1987 and 1995, based on actual and probable production capacities
(thousand metric tons, - denotes deficit + denotes surplus)

| | Bauxite | | Alumina | | Aluminium | |
|---|---|---|---|---|---|---|
| | 1987 | 1995 | 1987 | 1995 | 1987 | 1995 |
| North America | -10362 | -14342 | -6323 | -6375 | +466 | +1020 |
| Western Europe a/ | -6135 | -7737 | -2057 | -2288 | -305 | -940 |
| Japan | -2065 | -2065 | +180 | +180 | -1715 | -2130 |
| Oceania | +6982 | +6398 | +7626 | +7768 | +966 | +1144 |
| Africa b/ | +14580 | +16080 | -566 | -576 | +402 | +360 |
| Asia | +3270 | +1311 | -1140 | -2286 | -235 | +497 |
| Latin America/Caribbean | +10651 | +14660 | +2899 | +3464 | +687 | +1828 |
| Socialist countries in Eastern Europe c/ | -5565 | -5665 | -604 | -244 | +179 | +187 |
| Socialist countries in Asia c/ | +378 | 0 | -22 | 0 | -264 | 0 |
| Total | +11734 | +8640 | -7 | -357 | +181 | +1966 |

a/ Including Yugoslavia
b/ Including South Africa
c/ Based on actual and projected net trade
Sources: World Bank, op.cit., and UNCTAD secretariat.

Table 34
Tariff rates on bauxite, alumina and aluminium in developed market economy countries
(per cent ad valorem rates, except where otherwise indicated)

| | Bauxite | | Alumina | | Unwrought aluminium | | Semi-manufactures | |
|---|---|---|---|---|---|---|---|---|
| | MFN | GSP | MFN | GSP | MFN | GSP | MFN | GSP |
| Australia | 2 | 0 | 2 | 0 | 2.0 | | 15-20 | 0-10 |
| Austria | 0 | | 0 | | 6.6 | 3.3-7.1 | 11.1 | 3.5-7.5 |
| Canada | 0 | | 0 | | 4.0-10.2 | 0-6.5 | 2.1-10.2 | 0-6.5 |
| EEC | 0 | | 5.7 | 0 | 2.2-6.3 | 0 | 7-10 | 0 |
| Finland | 0 | | 0 | | 0 | | 1.4-6.2 | 0 |
| Japan | 0 | | 4.9-5.8 | 0 | 1 | 0 | 0-10.2 | 0 |
| New Zealand | 0 | | 0 | | 9.5 | 0 | 22-29 | 15-25 |
| Norway | 0 | | 0 | | 0 | | 0.9 | 0 |
| Sweden | 0 | | 0 | | 0 | | 0.3.2 | 0 |
| Switzerland | 0 | | SwFl/ ton | 0 | SwF220/ ton | 0-2.6 | SwF/330-770/ ton | 0-6.5 |
| United States | 0 | | 0 | | 0 | 0-2.6 | 0-8 | 0 |

Sources: General Agreement on Tariffs and Trade: Background Study on Aluminium and Aluminium Products (MDF/W/61/Add.1), 11 April 1986; and Non-Ferrous Metals and Minerals - Updated Information (MTN/GNG/NG3/W/18), 14December 1988.

226. One major problem faced by Latin American/Caribbean exporters is their relative disadvantage as regards marketing. Bauxite and alumina are almost always traded under long-term contracts, although the spot market for alumina has reached a certain importance in recent years. Latin American and Caribbean exporters mostly lack the extensive marketing network necessary to achieve the best possible conditions of sale and consequently often rely on traders to make the necessary arrangements. An added difficulty in the case of alumina is that the market is dominated by two transnational companies, Alcoa and Billiton, who together account for more than half of the alumina supply outside integrated alumina supply systems47/.

227. As regards aluminium, the marketing situation has been facilitated by the introduction of aluminium on the London Metal Exchange (LME). However, the LME is seen as a "market of last resort", in particular since until recently, the only LME warehouses were located in Europe. A warehouse is now in operation in Singapore, and several more are to be established in Japan in 1989, and later in North America. The LME might therefore become a more attractive marketing vehicule for Latin American aluminium producers in the future. The other exchange where aluminium is traded, Comex in New York, has a very small volume of activity and is not much used by the industry. Comex is however making efforts to enhance the attractiveness of its aluminium contract.

228. Aluminium exporters in Latin America will have to consider carefully their marketing strategy in the future. Two basic kinds of strategy could be envisaged: either the Latin American exporters remain sellers of bulk products, in which case investment in marketing systems could remain small, sales could be handled through traders, and prices would be close to LME quotations; or they decide to diversify into more specialized products such as special alloys, which would necessitate the establishment of more ambitious marketing systems, but which would yield higher prices. If the second strategy were to be chosen, it would probably also imply greater efforts to penetrate major markets for semi-manufactured products.

## B. Production for regional consumption

229. As Figure 1 in Chapter III showed, aluminium consumption in relation to GDP is relatively low in several countries in the Latin American/Caribbean region. This suggests that there exists a consumption potential that has yet to be realized. Part of the reason is no doubt the difficult economic conditions and forced restrictive policies of most Latin American and Caribbean countries in recent years. If the external debt problems facing these countries are resolved, the ensuing improved economic climate would certainly affect aluminium consumption. It is possible, however, that other forces contribute to depress consumption below the levels that could otherwise be achieved. In the following, some possible explanations will be discussed.

230. The high cost of transportation is undoubtedly one factor contributing to the relatively small size of intra-regional trade, not only for aluminium, but also for other products. Transport through the interior of the South American continent is slow and costly, while at the same time there are few frequently travelled regional shipping routes. Consequently, in many cases, delivery may be quicker and less costly from outside the region than from the region itself.

231. Tariff and non-tariff measures may also be assumed to constrain the development of aluminium consumption. Table 35 shows most favoured nation tariff rates for bauxite, alumina and aluminium in selected countries. It should be noted that the figures in the table do not take into account the preferences granted under regional trade agreements. While these preferences are substantial in many cases, it nevertheless seems likely that the relatively high tariff rates have a dampening effect on consumption.

Table 35
Tariff rates on bauxite, alumina and aluminium in selected
Latin American and Caribbean countries
(per cent ad valorem rate)

| | Bauxite | Alumina | Unwrought aluminium products | Semi-manufactured products | Finished |
|---|---|---|---|---|---|
| Argentina | 26.0 | 10.0-35.0 | 26.0-38.0 | 10.0-38.0 | 10.0- 38.( |
| Bolivia | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| Brazil | 15.0 | 30.0 | 0.0.37.0 | 45.0-60.0 | 45.0- 70.( |
| Chile | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| Colombia | 15.0 | 30.0 | 2.0 | 25.0-30.0 | 35.0- 55.( |
| Costa Rica | 5.0 | 5.0 | 5.0 | 5.0-35.0 | 5.0- 50.( |
| Ecuador | 0.0 | 0.0 | 0.0 | 5.0-70.0 | 5.0- 90.( |
| Jamaica | 0.0 | 5.0 | 5.0 | 10.0-15.0 | 20.0- 40.( |
| Mexico | 0.0 | 0.0 | 10.0 | 15.0 | 20.0 |
| Peru | 11.0 | 25.0 | 11.0-19.0 | 11.0-84.0 | 11.0- 84.( |
| Uruguay | 10.0 | 10.0 | 10.0 | 10.0-45.0 | 20.0- 45.( |
| Venezuela | 5.0 | 1.0 | 10.0 | 1.0-70.0 | 35.0-100.( |

Source: UNCTAD secretariat.

232 Most Latin American and Caribbean countries also make use of several different kinds of non-tariff measures48/, such as general import surcharges varying from 10 to 38 per cent (Argentina, Colombia, Paraguay, Peru and Trinidad and Tobago), stamp taxes of up to 5 per cent (Argentina, Bahamas, Belize, Nicaragua and Trinidad and Tobago), consular invoice fees of up to 7per cent (Argentina, Colombia, El Salvador, Nicaragua, Paraguay and Peru), taxes on transport facilities of up to 30 per cent of freight costs (Argentina, Brazil, Chile, Ecuador, Peru and Uruguay) taxes on foreign exchange transactions (Brazil, Uruguay and Venezuela) and other fiscal charges of different kinds levied at widely differing rates (Argentina, Colombia, Ecuador, Mexico, Nicaragua, Paraguay and Venezuela). In addition, many countries also require compulsory national insurance for imports (Argentina, Bolivia, Brazil, Colombia, Ecuador, Mexico, Nicaragua, Peru and Venezuela) or compulsory national transport (Argentina, Bolivia, Colombia, Ecuador, Guatemala, Mexico, Peru, Uruguay and Venezuela). Together with the already substantial tariffs, these non-tariff measures have the effects of drastically raising the cost of imports, and, given the multitude of different charges and regulations in many cases, of complicating foreign trade. In this context, it should be stressed that, while large companies with an established marketing infrastructure may be well able to handle these complications, smaller Latin American and Caribbean exporters may find the task impossible.

233. As was the case with exports to countries outside the region, intra-regional trade is likely to suffer from the relatively modest development of marketing capability.

## V. CONCLUSIONS AND RECOMMENDATIONS

### A. Opportunities and obstacles

234. As has been shown in earlier chapters, the bauxite/alumina/aluminium industry in Latin America and the Caribbean is internationally competitive as a result of favourable natural resource endowments. It is also growing rapidly, with the expansion expected to continue until the end of this century. This expansion by itself obviously poses problems of industrial development strategy at the same time as it provides the means for solving the problems. Either of two contrasting strategies could be adopted: Latin American and Caribbean countries could remain exporters to the rest of the world of the raw materials that can be produced relatively easily (bauxite and alumina in the case of the Caribbean countries, aluminium ingot in the case of Brazil and Venezuela), or they could opt for a more diversified strategy focussing on increased intra-regional trade and a higher degree of downstream processing. While there would appear to be no question about what option governments in the region would prefer, given the opportunities for increased value added production and greater contributions from this sector to the rest of the economy that the diversified strategy appears to offer, circumstances may not always be so favourable as to allow them to choose this strategy. Regional co-operation efforts could, however, facilitate its adoption and implementation.

235. While there are many obstacles to a diversified strategy, there also exists several circumstances that increase its realism and feasibility. Among these are:

- the existence of underutilized production capacity at different stages of production in several countries (bauxite and alumina in the Caribbean countries, semi-fabricated products in Argentina, Mexico and Venezuela);

- competitive production costs, which make increased downstream processing a viable option;

- low aluminium consumption relative to the level of economic development in most of the region's countries, which implies that markets can be further developed;

- a high standard of technological know-how, implying that technological barriers may not be an insurmountable obstacle49/.

236. Given these circumstances, efforts to increase intra-regional trade and downstream processing have a probability to yield positive results. There are, however, several obstacles that would have to be overcome. One fundamental difficulty is obviously the shortage of investment capital and scarcity of foreign exchange created by the external debt situation of more countries in the region. The evolvement of this situation will set the conditions for any initiatives that can be taken by governments. Other obstacles may be more amenable to actions by governments and/or enterprises. These include:

- the existence of barriers to trade in the form of tariffs and non-tariff measures taken by individual governments ;
- shortcomings of systems for payments, which tend to reduce the attractiveness of intra-regional trade;
- insufficiency of export credit;
- limited extent of market promotion activities;
- insufficiently developed marketing systems and capabilities50/;
- domestic price controls on ingot and processed products which at times create scarcity and bottlenecks and obstruct an efficient allocation of resources.

B. Recommendations

237 In the following, some recommendations are made which aim at reducing the importance of the obstacles mentioned in the foregoing. While these recommendations are of a rather sweeping nature, they may be taken as a starting point for a discussion about the concrete measures that can be taken by governments and enterprises in order to promote the development of the regions bauxite/alumina/aluminium industry. Finally, reference is made to some concrete projects, most of which have been suggested in the context of a "regional expert group meeting on the development of the non-ferrous metals industry in Latin America and possibilities for complementarity"51/, which was recently organized by UNIDO together with the Government of Argentina.

238. It is recommended that steps be taken to reduce the incidence of tariff and non-tariff measures on intra-regional trade in semi-manufactures and manufactured aluminium products. In this connexion, fuller implementation of the preference schemes already in existence should receive particular attention. Efforts should also be made to facilitate aluminium exports to other developing countries through the application of the Global System for Trade Preferences (GSTP).

239. Existing systems of payments should be reviewed with a view to facilitate trade in aluminium products between Latin American and Caribbean countries. In particular, export credit facilities should be improved.

240. Where possible, domestic price controls which have the effect of causing shortages and distorting production costs should be revised or eliminated.

241. Marketing systems and capabilities should be upgraded so as to allow increased exports, in particular of processed products, both within and outside the region. This upgrading could also have other benefits. It would allow the development of closer ties with consumers, which in turn would permit the industry to escape some of the adverse effects of a downturn in demand, and would keep producers in touch with developments in consumer requirements. Furthermore, more sophisticated trading strategies, involving for instance, use of the LME for hedging purposes, could be employed, and business risks could thereby be reduced. In this connexion, regional co-operation in the form of joint marketing enterprises and training programmes could play a significant role.

242. Co-operation between the producing companies of the region in the field of research and development, market analysis, product development and promotion of aluminium consumption should be enhanced. This work should be directed towards developing the use of aluminium in the regional market by identifying needs specific to the region. Household goods, transportation equipment and construction are examples of industry sectors which are oriented towards domestic or regional markets and where increased use of aluminium may result in quality improvements. National associations of aluminium producers and fabricators should provide the focal points for these efforts.

243. There exists a number of possible joint venture prospects which should be reviewed with a view to determine their economic and technical feasibility. Since these projects generally would involve government participation, it would be the task of governments and industry together to take the necessary steps to arrive at an evaluation.

244. As regards alumina, it has already been noted (see Chapter II, section C above) that the price of caustic soda, which is a major input in aluminium refining, has increased dramatically lately. The Latin American/Caribbean region is dependent on imports for more than half its needs and the recent price rise has obviously increased the vulnerability of the industry. Accordingly, the construction of a caustic soda plant in the region could be studied with a view to determine its economic viability and choose a suitable site.

245. A similar situation exists with regard to petroleum coke, which constitutes one of the main inputs to amuminium smelting, where it is used in carbon anodes. Here again, the construction of a plant based on local petroleum resources could be studies. The construction of joint venture smelters in the Caribbean region, based on regionally available energy and alumina, is a subject that has been discussed earlier without, so far, concrete results. This concept may merit resumed analysis.

246. Finally, the existence of unutilized capacity at the semi-fabrication stage of the industry in Argentina, Mexico and Venezuela, taken together with the planned expansion of primary aluminium production in Venezuela, would seem to call for an analysis of the possibilities of adapting the presently unused capacity to market needs. Thus, with minor modifications, it may be possible to raise significantly the degree of downstream processing in the industry.

Footnotes

1/ This strategy, however, could have a perverse effect in the medium to long run given the greater incentives to substitution.

2/ Alcan, Alcoa, Alusuisse, Kaiser, Pechiney and Reynolds.

3/ 1978 figures from Aluminium Conductor Development Corporation, Survey of Planned Increased in World Bauxite, Alumina and Aluminium Capacities 1975-1983, London, 1978; calculations of 1987 shares by UNCTAD secretariat.

4/ See, for instance, N. Girvan: "The Jamaican Production Levy - A View of the Past, a Vision of the Future" (IBA Journal, vol. 3, No. 1, Kingston, 1984).

5/ As for instance the more than two-fold reduction of volume of shipments compared to bauxite; the generally low or inexistent tariff barriers in consuming countries; the higher cost to producers implied by the environmental legislation of the consuming countries; and the pressure from bauxite producing countries to up-grade the level of processing of their natural resources.

6/ It should be noted, however, that production of non-metallurgical alumina in Western Europe has increased more than propotionally, thus accounting for part of the expansion of production.

7/ According to information received from ALUAR, the domestic price in October 1988 was about 1600 US dollars per ton. The average cash LME price (high grade contract) for that month was 2348.50US dollars.

8/ Metal Bulletin, London, 6 October 1988.

9/ Metal Bulletin, London 20 February 1989.

10/ Instituto Mexicano del Aluminio: Plan de Desarollo de la Industria del Aluminio en Mexico, Mexico, 1987.

11/ D. Morrison: Study on the Identification of Possibilities of Production Complementarities among the Producers of Aluminium and Nickel in the Caribbean Region. UNIDO, 1989 (ID/WG.481/4 (SPEC)).

12/ Tariffs on unwrought aluminium were temporarily abolished during a three month period in late 1988, in order to alleviate a shortage of metal.

13/ T. Grof, A. Eva: Identification of Specific Projects for the Production of Semi-Finished Non-Ferrous metals in Latin America. UNIDO, 1989 (ID/WG.481/2 (SPEC)).

14/ Figures in the table may not agree completely with those quoted elsewhere in this report due to differences in statistical classification.

15/ Most of the Latin American exports of semi-manufactured products to the United States were however accounted for by exports of redraw rod by one Venezuelan company. In July 1988, United States authorities decided to impose anti-dumping and countervailing duties totaling 44.2per cent on these imports, which have since then decreased drastically.

16/ World Bank, Worldwide Investment Analysis - The Case of Aluminium, Staff Working Paper No. 603, Washington, 1983.

17/ This section is based mainly on U.S. Bureau of Mines: Mineral Facts and Problems, 1985, and World Bank op. cit.

18/ Mining Annual Review, 1988.

19/ Aluminium - A Chapter from Mineral Facts and Problems, 1985 edition (pre print). United States Department of the Interior.

20/ Bhilotra, K (1986) in "Retrofitting of Alumina Calciners to Reduce Fuel Consumption" lists the options considered by Jamalcan of Jamaica before undertaking its modernization program.

21/ The number of employees probably includes non-production workers.

22/ U.S. Bureau of Mines, 1983. Aluminium Availability - op. cit.

23/ Adapted from: R. Robson and P. Frame: Criteria for Investment in Alumina Refining, Proceedings of Bauxite Symposium IV, 1980. The Journal of the Geological Society of Jamaica.

24/ Aluminium, Copper and Steel in Developing Countries. OECD, Development Centre Studies, Paris, 1987.

25/ ibid

26/ Alcoa's 1986 research budget was 142 million US dollars, and it was expected to double before the end of the decade (American Metal Market, 19 May 1986).

27/ Metal Bulletin Monthly, London, December 1985.

28/ In the Federal Republic of Germany, the share of non-ferrous metals mainly aluminium, in the weight of the average car increased from 5 per cent in 1985 to 9 per cent in 1988 (Metal Bulletin, London, 7 March 1988).

29/ This is the approach taken in a project sponsored by Hydro Aluminium (See Metalworking News, 23 November 1987, and American Metal Market, 2December 1987).

30/ The Aluminium Structured Vehicule (ASV) developed by Alcan uses this approach (see Metalworking News, 1 June 1987).

31/ So far the Airbus A320, which uses carbon fiber reinforced plastic for instance, in the tail section and parts of the wing assembly, is the only example of a commercial aircraft making extensive use of advanced composites (American Metal Market, 6 April 1988).

32/ American Metal Market, 3 November 1987.

33/ Metal Bulletin Monthly, London, August 1987.

34/ Japan Metal Bulletin, Tokyo, 18 June 1988.

35/ Study by Resource Strategies Inc., Exton, Pennsylvania, the United States, quoted in American Metal Market, 23 November 1988.

36/ American Metal Market, 9 December 1988.

37/ Metal Bulletin, 20February 1989.

38/ American Metal Market, 6 February 1987.

39/ American Metal Market, 9 December 1988.

40/ American Metal Market, 6 February 1987.

41/ World Bank: Price prospects for Major Primary Commodities Report No.814/88.

42/ A recent report prepared by a private consulting firm (Anthony Bird Associates: "Annual Review of the Aluminium Industry 1989", quoted in the McGraw-Hill's Metals Price Report - Base Metals, New York, 4April, 1989) forecasts a growth in aluminium consumption of just under 4per cent per year until the mid-1990's.

43/ Primary aluminium production in China increased from 400,000 to615,000 tons from 1982 to 1987, and is planned to increase further to 900,000 tons in 1990 (Metal Bulletin, London, 9 May and 14 July 1988).

44/ In 1988, Australia accounted for 29.8percent of Japanese imports of "ordinary grade" aluminium, followed by the United States with 16.3per cent, Brazil with 13.5per cent, New Zealand with 11.4per cent, Venezuela with 10.0per cent and Indonesia with 7.2 per cent (Japan Metal Bulletin, 21February, 1989).

45/ Metal Bulletin, London, 29 September 1988.

46/ In 1988, for instance, the ceilings for imports of unwrought and processed aluminium into Japan under the GSP scheme were exceeded already in June.

47/ M. Edwards: Structural Change in the Alumina Market. Presentation at the Metals Week Aluminium Symposium, Zurich, 19-20 October, 1987.

48/ According to the UNCTAD data bank on non-tariff measures.

49/ In Brazil, 95 per cent of bauxite mining equipment and 90 per cent of machinery and equipment for alumina refineries and aluminium smelters are produced locally (D. Morrison: op. cit.) However, technological barriers to entry do exist, in particular in the semi-manufactured products sector, as for instance in canstock production.

50/ For instance, 85 per cent of Brazils primary aluminium exports are handled by traders (Metal Bulletin Monthly, London, February 1989).

51/ See - The Promotion of a More Coherent Productive System in the Field of Non-Ferrous Metals in Latin America: Possibilities for Complementarity (UNIDO), ID/WG.481/5(SPEC).

# STATISTICAL ANNEX

Table A.1 : CONSUMPTION OF PRIMARY ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD.............. | 15354.0 | 16007.8 | 15304.5 | 14573.6 | 14243.8 | 15281.5 | 15839.6 | 15917.2 | 16402.3 | 17201.1 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 10647.3 | 11153.0 | 10446.1 | 9731.8 | 9352.5 | 10191.9 | 10643.6 | 10510.1 | 10749.7 | 11214.1 |
| AUSTRIA............ | 107.9 | 111.8 | 102.4 | 105.4 | 102.2 | 123.1 | 127.4 | 127.9 | 129.3 | 133.0 |
| AUSTRALIA.......... | 183.3 | 219.6 | 228.5 | 246.3 | 232.5 | 242.2 | 265.4 | 283.5 | 294.5 | 312.1 |
| BELGIUM............ | 256.6 | 242.0 | 232.9 | 215.3 | 253.6 | 272.0 | 289.4 | 267.7 | 273.3 | 284.7 |
| CANADA............. | 338.8 | 340.0 | 247.0 | 247.0 | 298.0 | 248.0 | 336.0 | 345.0 | 321.0 | 421.6 |
| DENMARK............ | 7.3 | 11.1 | 14.9 | 10.9 | 13.8 | 15.7 | 21.0 | 21.7 | 32.3 | 24.9 |
| FINLAND............ | 21.7 | 27.0 | 25.2 | 24.2 | 20.9 | 23.5 | 17.4 | 16.5 | 17.8 | 18.1 |
| FRANCE............. | 532.8 | 595.9 | 600.9 | 538.7 | 578.4 | 613.4 | 579.3 | 586.1 | 592.4 | 615.6 |
| GERMANY, FED REP... | 952.3 | 1067.8 | 1042.3 | 1021.8 | 1000.2 | 1085.0 | 1151.6 | 1160.9 | 1186.7 | 1185.7 |
| GREECE............. | 68.0 | 76.5 | 85.5 | 63.3 | 74.0 | 88.5 | 94.1 | 88.4 | 83.6 | 75.9 |
| ICELAND............ | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| IRELAND............ | 4.0 | 5.4 | 3.3 | 0.3 | 0.9 | 1.0 | 2.0 | 2.0 | 2.3 | 1.9 |
| ISRAEL............. | 24.2 | 19.1 | 19.7 | 14.2 | 13.8 | 14.4 | 12.8 | 13.8 | 15.9 | 16.0 |
| ITALY.............. | 404.0 | 448.0 | 458.0 | 413.0 | 420.0 | 430.0 | 448.0 | 470.0 | 510.0 | 548.0 |
| JAPAN.............. | 1656.1 | 1803.4 | 1639.0 | 1570.2 | 1639.3 | 1722.0 | 1696.0 | 1685.0 | 1700.0 | 1750.0 |
| NETHERLANDS........ | 94.7 | 100.1 | 106.3 | 72.8 | 88.7 | 87.2 | 107.6 | 88.9 | 122.6 | 111.2 |
| NEW ZEALAND........ | 21.6 | 27.0 | 25.0 | 29.2 | 24.0 | 26.1 | 29.3 | 34.7 | 29.7 | 33.8 |
| NORWAY............. | 84.0 | 97.5 | 118.4 | 111.2 | 129.4 | 128.6 | 126.9 | 129.3 | 123.0 | 129.3 |
| PORTUGAL........... | 20.0 | 20.9 | 27.4 | 41.9 | 49.0 | 42.6 | 25.3 | 31.7 | 39.0 | 43.1 |
| SOUTH AFRICA....... | 50.9 | 55.0 | 77.7 | 76.8 | 69.3 | 62.8 | 76.8 | 77.0 | 75.4 | 92.2 |
| SPAIN.............. | 235.6 | 234.8 | 263.4 | 201.7 | 223.2 | 217.4 | 191.4 | 211.0 | 244.0 | 259.2 |
| SWEDEN............. | 98.0 | 103.3 | 76.4 | 83.9 | 95.6 | 94.6 | 87.3 | 93.6 | 95.0 | 86.1 |
| SWITZERLAND........ | 105.0 | 111.3 | 118.2 | 107.0 | 111.3 | 115.3 | 135.0 | 142.9 | 156.4 | 149.2 |
| UNITED KINGDOM..... | 402.3 | 417.6 | 409.3 | 343.6 | 326.3 | 323.4 | 369.5 | 350.4 | 389.1 | 383.6 |
| U.S.A.............. | 4978.1 | 5017.7 | 4524.0 | 4193.0 | 3588.0 | 4215.0 | 4454.0 | 4282.0 | 4316.0 | 4536.0 |
| DEVELOPING COUNTRIES.......... | 1391.7 | 1491.8 | 1547.9 | 1560.4 | 1585.1 | 1774.0 | 1925.3 | 2052.1 | 2287.1 | 2483.1 |
| AFRICA............. | 86.6E | 88.9E | 101.5E | 108.5E | 111.0E | 124.4E | 126.0E | 127.6 | 124.4 | 139.1 |
| AFRICA NES......... | 15.8 | 13.1 | 12.6 | 18.4 | 17.1 | 12.0E | 13.0E | 16.0E | 17.0E | 12.0E |
| ALGERIA............ | 2.8 | 0.9 | 3.6 | 3.5 | 3.8 | 3.4 | 6.8 | 5.8 | 6.6 | 7.6 |
| CAMEROON........... | 23.8 | 26.9 | 29.5 | 27.7 | 24.0 | 27.9 | 24.8 | 29.5 | 27.8 | 24.6 |
| EGYPT.............. | 32.0E | 35.0E | 40.0E | 50.0E | 58.0E | 67.0E | 70.0E | 62.9 | 58.0 | 77.1 |
| GHANA.............. | 6.0E | 6.0E | 6.0E | 6.0E | 6.0E | 6.0E | 6.0E | 6.0E | 5.0 | 7.8 |
| NIGERIA............ | 6.2 | 7.0 | 9.8 | 2.9 | 2.1 | 8.1E | 5.4E | 7.4E | 10.0E | 10.0E |
| AMERICA............ | 498.1 | 567.6 | 605.7 | 537.3 | 506.8 | 550.9 | 646.4 | 706.5 | 806.7 | 850.5E |
| AMER. NES.......... | 19.0 | 22.0 | 23.0E | 26.0E | 25.0E | 28.0E | 24.5 | 30.0 | 35.0 | 25.1 |
| ARGENTINA.......... | 60.5 | 81.1 | 59.5 | 52.5 | 62.9 | 80.4 | 101.2 | 80.9 | 121.3 | 142.0 |
| BRAZIL............. | 240.4 | 265.7 | 296.4 | 261.7 | 281.9 | 270.6 | 294.8 | 347.5 | 423.7 | 430.3 |
| CHILE.............. | 4.3E | 4.9E | 4.9E | 6.7E | 5.0E | 5.0E | 1.2E | 4.8E | 6.5E | 8.5E |
| COLOMBIA........... | 17.4 | 16.4 | 13.5 | 15.7 | 14.3 | 17.4 | 18.0 | 22.4 | 25.3 | 22.3 |
| CUBA............... | 1.0 | 1.2 | 1.2 | 1.5 | 1.5 | 1.8 | 2.0 | 2.5 | 2.5 | 3.0 |
| MEXICO............. | 83.3 | 99.6 | 105.6 | 99.5 | 64.4 | 55.9 | 71.0 | 76.0 | 52.0 | 68.1 |
| PERU............... | 3.2 | 2.7 | 5.4 | 4.8 | 3.9 | 2.8E | 3.4 | 3.7 | 5.4 | 6.2E |
| VENEZUELA.......... | 69.0 | 74.0 | 96.2 | 68.9 | 47.9 | 89.0 | 130.3 | 138.7 | 135.0 | 145.0E |

Table A.1 : CONSUMPTION OF PRIMARY ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| **ASIA...............** | **641.9** | **661.5** | **657.6** | **733.4** | **792.3** | **925.0** | **922.8** | **985.5** | **1125.6** | **1284.6** |
| BAHRAIN............ | 7.1 | 11.0 | 20.1 | 16.9 | 12.2 | 21.3 | 18.3 | 21.5 | 46.5 | 64.5 |
| BANGLADESH......... | 1.8 | 1.0 | 4.8 | 3.1 | 8.0 | 4.7 | 12.3 | 16.5 | 12.8 | 20.0 |
| HONG KONG.......... | 22.9 | 24.5 | 30.1 | 21.6 | 23.3 | 30.6 | 12.9 | 27.2 | 20.8 | 34.3 |
| INDIA.............. | 205.4 | 211.9 | 233.8 | 249.6 | 219.7 | 218.5 | 310.0 | 297.6 | 310.0 | 326.0 |
| INDONESIA.......... | 12.3 | 15.2 | 14.1 | 21.2 | 34.0 | 35.0E | 35.0E | 41.0 | 51.4 | 68.0 |
| IRAN............... | 53.4 | 23.1 | 22.7 | 33.0 | 68.0E | 105.0 | 67.4 | 56.0 | 89.0 | 90.0 |
| IRAQ............... | 8.0E | 2.8E | 14.9E | 26.4E | 17.3E | 6.6 | 10.0 | 10.0E | 17.0 | 20.0 |
| KOREA REP.......... | 105.8 | 94.3 | 67.5 | 103.6 | 97.1 | 120.0 | 128.8 | 145.6 | 196.8 | 207.9 |
| LEBANON............ | 13.4 | 15.4 | 15.8 | 11.7 | 3.2E | 11.0 | 6.1 | 8.9 | 12.1 | 10.0 |
| MALAYSIA........... | 14.5 | 24.1 | 16.4 | 14.8 | 22.5 | 41.4 | 31.6 | 21.7 | 26.4 | 27.0 |
| PAKISTAN........... | 4.5 | 3.8 | 3.2 | 0.7 | 6.4 | 3.1 | 6.7 | 5.3 | 8.9 | 10.0 |
| PHILIPP............ | 16.8 | 28.4 | 17.1 | 10.4 | 18.5 | 14.8 | 6.6 | 4.9 | 6.3 | 10.6 |
| SAUDI ARABIA....... | 0.5 | 1.0 | 3.9 | 3.0 | 6.3 | 9.1 | 13.8 | 9.3 | 14.3 | 18.6 |
| SINGAPORE.......... | 4.2 | 2.8 | 5.0 | 5.4 | 5.4 | 5.3 | 3.7 | 6.8 | 8.7 | 6.0 |
| TAIWAN............. | 89.9 | 109.0 | 91.9 | 77.8 | 113.6 | 136.5 | 96.8 | 147.8 | 150.4 | 177.8 |
| THAILAND........... | 33.7 | 42.9 | 44.9 | 51.7 | 58.8 | 64.9 | 49.2 | 44.7 | 47.8 | 53.8 |
| TURKEY............. | 45.0 | 44.8 | 45.0 | 74.6 | 70.6 | 89.2 | 106.4 | 113.3 | 98.4 | 131.0 |
| U.A.EMIRAT......... | 2.7 | 5.5 | 6.4 | 7.9 | 7.4 | 8.0 | 7.2 | 7.4 | 8.0 | 9.1 |
| O.ASIA NES......... | 5.5 | 8.0 | 14.0 | 14.0 | 14.0 | 21.0E | 22.0E | 23.0E | 25.0E | 40.0E |
| O.OC.NES........... | 0.0 | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| **EUROPE.............** | **159.6** | **165.8** | **168.2** | **167.1** | **161.0** | **152.7** | **208.1** | **209.5** | **205.4** | **168.8** |
| YUGOSLAVIA......... | 159.6 | 165.8 | 168.2 | 167.1 | 161.0 | 152.7 | 208.1 | 209.5 | 205.4 | 168.8 |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF EASTERN EUROPE...** | **2725.0E** | **2748.0E** | **2724.5E** | **2686.4E** | **2686.2E** | **2655.6E** | **2595.7E** | **2605.0E** | **2560.5E** | **2641.9E** |
| ALBANIA............ | 1.5E | 1.6E | 2.0E | 2.0E | 2.0E | 2.0E | 2.5E | 2.5E | 2.5E | 2.5E |
| BULGARIA........... | 47.0 | 48.0 | 50.0 | 50.0 | 55.0 | 53.0 | 55.0 | 55.0 | 57.0 | 56.0 |
| CZECHOSLOVAKIA..... | 131.3 | 125.0 | 131.3 | 114.7 | 99.8 | 124.2 | 121.6 | 111.7 | 111.1 | 108.4 |
| GERMAN DR.......... | 225.0E | 220.0E | 220.0 | 222.0 | 215.0 | 215.0 | 218.0 | 230.0E | 227.0 | 222.0 |
| HUNGARY............ | 169.8 | 166.4 | 165.8 | 168.1 | 177.4 | 181.7 | 192.8 | 199.5 | 209.4 | 197.9 |
| POLAND............. | 173.4 | 170.0 | 158.4 | 125.6 | 125.0 | 128.2 | 134.2 | 130.4 | 133.5 | 135.1 |
| ROMANIA............ | 146.5 | 152.0 | 147.0 | 144.0 | 132.0 | 101.5 | 121.6 | 125.9 | 120.0 | 120.0 |
| USSR............... | 1830.0E | 1865.0E | 1850.0E | 1860.0E | 1880.0E | 1850.0E | 1750.0E | 1750.0E | 1700.0E | 1800.0E |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF ASIA............** | **590.0** | **615.0** | **586.0** | **595.0** | **620.0** | **660.0** | **675.0** | **750.0** | **805.0** | **862.0E** |
| CHINA.............. | 560.0 | 580.0 | 550.0 | 560.0 | 580.0 | 620.0 | 630.0 | 700.0E | 750.0E | 800.0E |
| KOREA DPR.......... | 27.0 | 32.0 | 32.0 | 31.0 | 36.0 | 36.0 | 41.0 | 45.0 | 50.0 | 55.0 |
| VIETNAM............ | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.0 | 5.0 | 7.0E |

Table A.2 : CONSUMPTION OF PRIMARY AND SECONDARY ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 15326.8 | 16180.1 | 15587.7 | 15055.1 | 14601.7 | 15940.8 | 16836.3 | 17052.5 | 17549.8 | 18583.3 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 13788.8 | 14521.2 | 13868.7 | 13335.9 | 12830.0 | 13953.4 | 14689.9 | 14721.2 | 14975.7 | 15806.6 |
| AUSTRIA............ | 115.8 | 117.3 | 112.3 | 112.9 | 115.0 | 141.3 | 156.7 | 170.9 | 167.9 | 162.2 |
| AUSTRALIA.......... | 207.7 | 250.1 | 266.5 | 290.7 | 273.2 | 279.9 | 306.4 | 328.5 | 350.4 | 351.1 |
| BELGIUM............ | 257.7 | 244.0 | 232.9 | 215.3 | 253.6 | 273.0 | 291.4 | 269.7 | 275.3 | 287.9 |
| CANADA............. | 413.6 | 425.5 | 312.1 | 306.3 | 348.6 | 304.0 | 415.7 | 420.8 | 391.0 | 501.6 |
| DENMARK............ | 18.0 | 21.2 | 26.1 | 21.8 | 25.3 | 28.3 | 30.5 | 32.7 | 46.2 | 38.4 |
| FINLAND............ | 28.7 | 35.0 | 34.2 | 33.5 | 30.3 | 36.7 | 34.6 | 37.5 | 40.0 | 49.2 |
| FRANCE............. | 683.0 | 754.7 | 753.2 | 694.2 | 731.5 | 755.6 | 727.6 | 743.2 | 770.2 | 818.5 |
| GERMANY, FED REP... | 1336.4 | 1487.2 | 1455.0 | 1418.5 | 1400.1 | 1554.7 | 1705.1 | 1751.0 | 1796.3 | 1812.8 |
| GREECE............. | 68.0 | 76.5 | 85.5 | 63.3 | 74.0 | 90.5 | 96.1 | 93.9 | 89.6 | 79.9 |
| ICELAND............ | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2E | 0.5E |
| IRELAND............ | 4.0 | 5.4 | 3.6 | 0.3 | 0.9 | 1.0 | 2.0 | 2.0 | 2.6E | 3.0E |
| ITALY.............. | 668.0 | 731.0 | 789.0 | 715.0 | 711.0 | 755.0 | 807.0 | 833.0 | 879.0 | 977.0 |
| JAPAN.............. | 2096.1 | 2279.4 | 2193.8 | 2137.5 | 2232.6 | 2353.5 | 2444.4 | 2471.3 | 2491.1 | 2550.2 |
| NETHERLANDS........ | 138.7 | 146.7 | 160.0 | 123.0 | 138.5 | 145.4 | 167.5 | 172.2 | 219.4 | 212.6 |
| NEW ZEALAND........ | 23.1 | 29.0 | 27.0 | 32.2 | 26.7 | 29.1 | 33.0 | 38.7 | 33.7 | 37.8 |
| NORWAY............. | 88.0 | 101.1 | 122.9 | 114.1 | 132.2 | 129.3 | 129.2 | 130.8 | 125.0E | 131.3E |
| PORTUGAL........... | 23.1 | 24.7 | 30.0 | 43.9 | 50.9 | 45.0 | 27.4 | 33.8 | 41.0 | 45.1 |
| SOUTH AFRICA....... | 61.1 | 71.5 | 104.9 | 105.1 | 96.5 | 94.5 | 105.0 | 102.0 | 102.4 | 119.2 |
| SPAIN.............. | 272.8 | 275.6 | 304.7 | 236.2 | 258.9 | 254.8 | 232.0 | 253.5 | 292.9 | 329.2 |
| SWEDEN............. | 102.3 | 127.3 | 100.9 | 108.6 | 122.5 | 122.3 | 118.2 | 124.0 | 127.8 | 116.1 |
| SWITZERLAND........ | 114.8 | 122.1 | 129.9 | 116.9 | 120.2 | 124.5 | 146.6 | 155.8 | 166.7 | 159.1 |
| UNITED KINGDOM..... | 567.6 | 560.4 | 519.4 | 464.1 | 432.4 | 445.8 | 497.3 | 467.7 | 493.3 | 497.0 |
| U.S.A.............. | 6496.1 | 6629.7 | 6101.0 | 5982.0 | 5254.0 | 5988.0 | 6214.0 | 6086.0 | 6071.0 | 6522.0 |
| W.EUROPE NES....... | 4.1 | 5.6 | 3.7 | 0.4 | 1.0 | 1.1 | 2.1 | 2.1 | 2.7 | 4.9 |
| DEVELOPING COUNTRIES........... | 1538.0 | 1658.9 | 1719.0 | 1719.2 | 1771.7 | 1987.4 | 2146.4 | 2331.3 | 2574.1 | 2776.7 |
| **AFRICA.............** | **90.0** | **90.0** | **100.0** | **110.0** | **110.0** | **130.0** | **140.0** | **140.0** | **140.0** | **150.0** |
| AFRICA NES......... | 90.0 | 90.0 | 100.0 | 110.0 | 110.0 | 130.0 | 140.0 | 140.0 | 140.0 | 150.0 |
| **AMERICA............** | **554.7** | **647.7** | **691.9** | **603.9** | **595.2** | **636.0** | **737.2** | **803.6** | **903.6** | **947.3E** |
| AMER. NES.......... | 40.0 | 40.0 | 50.0 | 50.0 | 50.0 | 55.0E | 50.0E | 70.0E | 80.0E | 70.0E |
| ARGENTINA.......... | 68.5 | 90.9 | 66.5 | 57.5 | 68.9 | 87.4 | 108.7 | 84.5 | 127.8 | 149.8 |
| BRAZIL............. | 271.6 | 318.1 | 346.5 | 297.7 | 328.2 | 313.6 | 343.6 | 392.3 | 472.9 | 480.6 |
| MEXICO............. | 95.6 | 114.5 | 122.7 | 119.8 | 90.2 | 71.0 | 90.6 | 98.1 | 65.9 | 76.9 |
| VENEZUELA.......... | 79.0 | 84.2 | 106.2 | 78.9 | 57.9 | 109.0 | 144.3 | 158.7 | 157.0 | 170.0E |
| **ASIA...............** | **113.9** | **103.6** | **74.6** | **114.0** | **109.2** | **133.3** | **147.1** | **163.3** | **208.7** | **222.0** |
| KOREA REP.......... | 113.9 | 103.6 | 74.6 | 114.0 | 109.2 | 133.3 | 147.1 | 163.3 | 208.7 | 222.0 |
| O.ASIA NES......... | 600.0 | 630.0 | 660.0 | 700.0 | 770.0 | 910.0 | 880.0 | 970.0 | 1070.0E | 1250.0 |
| O.OC.NES........... | 0.0 | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| **EUROPE.............** | **179.4** | **187.6** | **191.6** | **191.2** | **187.3** | **178.1** | **242.1** | **254.4** | **251.8** | **207.3** |
| YUGOSLAVIA......... | 179.4 | 187.6 | 191.6 | 191.2 | 187.3 | 178.1 | 242.1 | 254.4 | 251.8 | 207.3 |

Table A.3 : PRODUCTION OF BAUXITE

(Thousand metric tons gross weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 87804.6 | 91439.6 | 95495.3 | 90891.3 | 79676.4 | 81323.2 | 94114.5 | 90944.9 | 94135.1 | 96742.4 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 30880.7 | 34492.8 | 33903.8 | 32251.5 | 29080.8 | 29221.8 | 36354.4 | 36581.1 | 36583.5 | 38745.4 |
| AUSTRALIA.......... | 24293.0 | 27583.0 | 27179.0 | 25441.0 | 23625.0 | 24373.0 | 31537.0 | 31839.0 | 32384.0 | 34206.0 |
| FRANCE............. | 1977.8 | 1969.5 | 1892.0 | 1828.0 | 1737.0 | 1595.0 | 1530.0 | 1530.0 | 1379.0 | 1388.0 |
| GREECE............. | 2663.8 | 2812.0 | 3012.0 | 3218.0 | 2846.0 | 2455.0 | 2296.0 | 2435.0 | 2231.0 | 2472.0 |
| ITALY.............. | 24.2 | 26.1 | 23.0 | 19.0 | 24.0 | 13.0 | 0.0 | 0.0 | 0.0 | 17.0 |
| SPAIN.............. | 3.0 | 8.2 | 5.0 | 9.0 | 7.0 | 5.0 | 7.0 | 2.0 | 3.0 | 0.0 |
| U.S.A.............. | 1918.9 | 2094.0 | 1792.8 | 1736.5 | 841.8 | 780.8 | 984.4 | 775.1 | 586.5 | 662.4 |
| DEVELOPING COUNTRIES........... | 45216.1 | 45470.8 | 50091.5 | 47125.8 | 39138.6 | 40364.4 | 45806.1 | 42058.8 | 45104.6 | 46816.0 |
| AFRICA............. | 13783.9 | 14244.0 | 14878.0 | 13624.0 | 12529.0 | 13864.0 | 15852.0 | 15345.0 | 16309.0 | 17899.0 |
| GHANA.............. | 329.9 | 180.0 | 197.0 | 181.0 | 64.0 | 70.0 | 49.0 | 170.0 | 204.0 | 196.0 |
| GUINEA............. | 12733.0 | 13379.0 | 13911.0 | 12822.0 | 11827.0 | 12986.0 | 14738.0 | 13956.0 | 14835.0 | 16282.0 |
| MOZAMBIQUE......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 | 4.0 | 5.0 |
| SIERRA LEONE....... | 716.0 | 680.0 | 766.0 | 616.0 | 630.0 | 785.0 | 1042.0 | 1185.0 | 1242.0 | 1391.0 |
| ZIMBABWE........... | 5.0 | 5.0 | 4.0 | 5.0 | 8.0 | 23.0 | 23.0 | 29.0 | 24.0 | 25.0 |
| AMERICA............ | 25131.8 | 24663.9 | 27574.5 | 25803.8 | 19287.6 | 19435.4 | 22711.1 | 19295.8 | 21175.6 | 21377.0 |
| BRAZIL............. | 1130.6 | 1642.2 | 4152.0 | 4463.0 | 4187.0 | 5239.0 | 6433.0 | 5846.0 | 6446.0 | 6567.0 |
| DOMIN,REP.......... | 664.3 | 598.9 | 587.6 | 471.5 | 174.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| GUYANA............. | 3999.1 | 3855.4 | 3509.8 | 2755.4 | 2050.5 | 2569.1 | 2857.8 | 2536.9 | 2990.0 | 3203.0 |
| HAITI.............. | 734.5 | 595.7 | 548.5 | 642.0 | 433.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JAMAICA............ | 13490.3 | 13230.7 | 13873.6 | 13346.9 | 9381.7 | 8834.3 | 10045.3 | 7174.9 | 8008.6 | 8809.0 |
| SURINAM............ | 5113.0 | 4741.0 | 4903.0 | 4125.0 | 3060.0 | 2793.0 | 3375.0 | 3738.0 | 3731.0 | 2581.0 |
| VENEZUELA.......... | 0.0N | 0.0N | 0.0N | 0.0N | 0.0N | 0.0 | 0.0 | 0.0 | 0.0 | 217.0 |
| ASIA............... | 3734.4 | 3550.9 | 4501.0 | 4449.0 | 3654.0 | 3565.0 | 3896.0 | 3880.0 | 4161.0 | 4146.0 |
| INDIA.............. | 1662.6 | 1954.0 | 1785.0 | 1955.0 | 1854.0 | 1976.0 | 2078.0 | 2341.0 | 2662.0 | 2779.0 |
| INDONESIA.......... | 1007.7 | 1052.0 | 1249.0 | 1203.0 | 700.0 | 778.0 | 1003.0 | 831.0 | 650.0 | 635.0 |
| MALAYSIA........... | 615.1 | 386.5 | 920.0 | 701.0 | 589.0 | 502.0 | 680.0 | 492.0 | 566.0 | 482.0 |
| PAKISTAN........... | 0.0 | 1.0 | 0.0 | 0.0 | 3.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 |
| TURKEY............. | 449.0 | 157.4 | 547.0 | 590.0 | 508.0 | 306.0 | 132.0 | 214.0 | 280.0 | 247.0 |
| EUROPE............. | 2566.0 | 3012.0 | 3138.0 | 3249.0 | 3668.0 | 3500.0 | 3347.0 | 3538.0 | 3459.0 | 3394.0 |
| YUGOSLAVIA......... | 2566.0 | 3012.0 | 3138.0 | 3249.0 | 3668.0 | 3500.0 | 3347.0 | 3538.0 | 3459.0 | 3394.0 |
| SOCIALIST COUNTRIES OF EASTERN EUROPE... | 10307.8 | 9976.0 | 9800.0 | 9714.0 | 9407.0 | 9637.0 | 9654.0 | 9675.0 | 9797.0 | 8431.0 |
| HUNGARY............ | 2899.8 | 2976.0 | 2950.0 | 2914.0 | 2627.0 | 2917.0 | 2994.0 | 2815.0 | 3022.0 | 3101.0 |
| ROMANIA............ | 708.0 | 500.0 | 450.0 | 400.0 | 380.0 | 420.0 | 460.0 | 460.0 | 500.0 | 480.0 |
| USSR............... | 6700.0 | 6500.0 | 6400.0 | 6400.0 | 6400.0 | 6300.0 | 6200.0 | 6400.0 | 6275.0 | 4850.0 |

Table A.3 : PRODUCTION OF BAUXITE

(Thousand metric tons gross weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| SOCIALIST COUNTRIES OF ASIA............. | 1400.0 | 1500.0 | 1700.0 | 1800.0 | 2050.0 | 2100.0 | 2300.0 | 2630.0 | 2650.0 | 2750.0 |
| CHINA.............. | 1400.0 | 1500.0 | 1700.0 | 1800.0 | 2050.0 | 2100.0 | 2300.0 | 2630.0 | 2650.0 | 2750.0 |

Table [illegible] 4 : PRODUCTION OF ALUMINA

(Thousand metric tons actual weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD.............. | 31073.4 | 32524.0 | 34737.0 | 33873.0 | 29631.0 | 31270.0 | 35252.6 | 33815.0 | 34680.0 | 36471.0 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 19893.8 | 20927.0 | 22213.0 | 21056.0 | 17724.0 | 18364.0 | 21282.0 | 19495.0 | 19592.0 | 21030.0 |
| AUSTRALIA.......... | 6775.8 | 7415.0 | 7247.0 | 7079.0 | 6631.0 | 7231.0 | 8781.0 | 8792.0 | 9423.0 | 10109.0 |
| CANADA............. | 1053.6 | 824.0 | 1202.0 | 1208.0 | 1127.0 | 1116.0 | 1126.0 | 1019.0 | 1015.0 | 952.0 |
| FRANCE............. | 1221.0 | 1239.0 | 1339.0 | 1236.0 | 1087.0 | 1009.0 | 1031.0 | 877.0 | 884.0 | 866.0 |
| GERMANY, FED REP... | 1555.6 | 1539.0 | 1608.0 | 1651.0 | 1509.0 | 1580.0 | 1701.0 | 1657.0 | 1560.0 | 1315.0 |
| GREECE............. | 477.6 | 496.0 | 505.0 | 502.0 | 419.0 | 436.0 | 487.0 | 402.0 | 458.0 | 529.0 |
| IRELAND............ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 105.0 | 650.0 | 557.0 | 685.0 | 787.0 |
| ITALY.............. | 819.0 | 854.0 | 900.0 | 786.0 | 698.0 | 466.0 | 625.0 | 555.0 | 618.0 | 700.0 |
| JAPAN.............. | 1767.2 | 1822.0 | 2218.0 | 1619.0 | 1212.0 | 1378.0 | 1488.0 | 1336.0 | 986.0 | 711.0 |
| SPAIN.............. | 0.0 | 0.0 | 62.0 | 695.0 | 673.0 | 729.0 | 742.0 | 725.0 | 748.0 | 801.0 |
| UNITED KINGDOM..... | 94.0 | 88.0 | 102.0 | 90.0 | 88.0 | 94.0 | 106.0 | 110.0 | 110.0 | 110.0 |
| U.S.A.............. | 6130.0 | 6650.0 | 7030.0 | 6190.0 | 4280.0 | 4220.0 | 4545.0 | 3465.0 | 3105.0 | 4150.0 |
| DEVELOPING COUNTRIES........... | 5817.2 | 6246.0 | 7102.0 | 6832.0 | 5654.0 | 6361.0 | 7284.6 | 7482.0 | 8001.0 | 8127.0 |
| AFRICA............. | 621.6 | 662.0 | 708.0 | 679.0 | 578.0 | 564.0 | 535.0 | 565.0 | 572.0 | 542.0 |
| GUINEA............. | 621.6 | 662.0 | 708.0 | 679.0 | 578.0 | 564.0 | 535.0 | 565.0 | 572.0 | 542.0 |
| AMERICA............ | 4085.6 | 4114.0 | 4624.0 | 4489.0 | 3435.0 | 4250.0 | 4970.6 | 5095.0 | 5584.0 | 5728.0 |
| BRAZIL............. | 434.0 | 449.0 | 493.0 | 520.0 | 552.0 | 629.0 | 882.0 | 1096.0 | 1258.0 | 1396.0 |
| GUYANA............. | 249.6 | 280.0 | 296.0 | 170.0 | 73.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JAMAICA............ | 2141.0 | 2074.0 | 2395.0 | 2550.0 | 1758.0 | 1907.0 | 1712.6 | 1622.0 | 1586.0 | 1609.0 |
| SURINAM............ | 1261.0 | 1311.0 | 1440.0 | 1249.0 | 1052.0 | 1154.0 | 1237.0 | 1242.0 | 1471.0 | 1363.0 |
| VENEZUELA.......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 560.0 | 1139.0 | 1135.0 | 1269.0 | 1360.0 |
| ASIA............... | 613.0 | 634.0 | 712.0 | 627.0 | 569.0 | 537.0 | 644.0 | 684.0E | 728.0 | 745.0 |
| INDIA.............. | 488.0 | 500.0 | 494.0 | 489.0 | 485.0 | 480.0 | 569.0 | 571.0 | 586.0 | 650.0 |
| TAIWAN............. | 51.0 | 59.0 | 80.0 | 19.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TURKEY............. | 74.0 | 75.0 | 138.0 | 119.0 | 84.0 | 57.0 | 75.0 | 113.0E | 142.0 | 95.0 |
| EUROPE............. | 497.0 | 836.0 | 1058.0 | 1037.0 | 1072.0 | 1010.0 | 1135.0 | 1138.0 | 1117.0 | 1112.0 |
| YUGOSLAVIA......... | 497.0 | 836.0 | 1058.0 | 1037.0 | 1072.0 | 1010.0 | 1135.0 | 1138.0 | 1117.0 | 1112.0 |
| SOCIALIST COUNTRIES OF EASTERN EUROPE... | 4662.4 | 4651.0 | 4722.0 | 5285.0 | 5383.0 | 5645.0 | 5726.0 | 5818.0 | 6027.0 | 6099.0 |
| CZECHOSLOVAKIA..... | 90.0 | 90.0 | 90.0 | 90.0 | 80.0 | 80.0 | 85.0 | 75.0 | 70.0 | 75.0 |
| GERMAN DR.......... | 38.0 | 41.0 | 43.0 | 45.0 | 46.0 | 42.0 | 43.0 | 47.0 | 46.0 | 46.0 |
| HUNGARY............ | 785.4 | 818.0 | 805.0 | 792.0 | 743.0 | 836.0 | 846.0 | 798.0 | 856.0 | 858.0 |
| ROMANIA............ | 449.0 | 502.0 | 534.0 | 558.0 | 514.0 | 512.0 | 552.0 | 548.0 | 555.0 | 540.0 |
| USSR............... | 3300.0 | 3200.0 | 3250.0 | 3800.0 | 4000.0 | 4175.0 | 4200.0 | 4350.0 | 4500.0 | 4580.0 |
| SOCIALIST COUNTRIES OF ASIA............. | 700.0 | 700.0 | 700.0 | 700.0 | 870.0 | 900.0 | 960.0 | 1020.0 | 1060.0 | 1215.0 |

Table A.4 : PRODUCTION OF ALUMINA

(Thousand metric tons actual weight)

| | *1978* | *1979* | *1980* | *1981* | *1982* | *1983* | *1984* | *1985* | *1986* | *1987* |
|---|---|---|---|---|---|---|---|---|---|---|
| CHINA............. | 700.0 | 700.0 | 700.0 | 700.0 | 870.0 | 900.0 | 960.0 | 1020.0 | 1060.0 | 1215.0 |

## Table A.5 : PRODUCTION OF PRIMARY ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 14768.6 | 15168.7 | 16050.9 | 15690.6 | 13964.1 | 14347.0 | 15987.9 | 15575.6 | 15589.0 | 16326.7 |
| **DEVELOPED MARKET ECONOMY COUNTRIES...** | **10306.4** | **10365.6** | **10957.2** | **10547.1** | **8657.1** | **8886.5** | **10273.9** | **9595.9** | **9215.4** | **9825.5** |
| AUSTRIA............ | 91.3 | 92.7 | 94.4 | 94.2 | 93.9 | 94.2 | 95.8 | 94.1 | 92.5 | 93.4 |
| AUSTRALIA.......... | 263.4 | 269.6 | 303.5 | 379.4 | 381.2 | 475.1 | 754.8 | 851.7 | 876.8 | 1024.2 |
| CANADA............. | 1048.5 | 863.6 | 1068.2 | 1115.7 | 1070.0 | 1091.2 | 1221.0 | 1282.3 | 1355.2 | 1540.4 |
| FRANCE............. | 391.4 | 395.1 | 431.9 | 435.6 | 390.4 | 360.8 | 341.5 | 293.2 | 321.8 | 322.5 |
| GERMANY. FED REP... | 739.6 | 741.9 | 730.7 | 728.9 | 722.8 | 743.3 | 777.2 | 745.3 | 763.7 | 737.7 |
| GREECE............. | 143.9 | 140.8 | 145.6 | 146.1 | 134.9 | 136.2 | 136.2 | 123.4 | 124.4 | 126.1 |
| ICELAND............ | 73.8 | 72.1 | 74.8 | 74.6 | 77.0 | 77.0 | 82.4 | 76.8 | 80.0 | 84.6 |
| ITALY.............. | 270.8 | 269.1 | 271.2 | 273.8 | 232.9 | 195.7 | 230.2 | 224.1 | 242.6 | 232.6 |
| JAPAN.............. | 1057.7 | 1010.4 | 1091.5 | 770.6 | 350.7 | 255.9 | 286.7 | 226.7 | 140.2 | 40.6 |
| NETHERLANDS........ | 259.2 | 255.6 | 258.2 | 261.9 | 248.2 | 236.3 | 247.3 | 244.6 | 258.0 | 268.7 |
| NEW ZEALAND........ | 151.1 | 154.1 | 156.2 | 155.4 | 166.8 | 220.1 | 242.9 | 243.5 | 236.2 | 252.0 |
| NORWAY............. | 656.9 | 673.5 | 662.0 | 636.1 | 645.1 | 715.4 | 760.8 | 724.1 | 729.1 | 797.8 |
| SOUTH AFRICA....... | 81.1 | 86.3 | 86.6 | 85.3 | 107.1 | 163.8 | 167.4 | 164.6 | 169.6 | 170.6 |
| SPAIN.............. | 212.1 | 259.5 | 386.5 | 396.6 | 366.5 | 357.6 | 380.8 | 370.1 | 354.7 | 342.0 |
| SWEDEN............. | 82.0 | 82.0 | 81.6 | 82.7 | 78.9 | 82.2 | 82.8 | 83.7 | 77.1 | 81.5 |
| SWITZERLAND........ | 79.5 | 83.0 | 86.3 | 82.2 | 75.3 | 76.0 | 79.2 | 72.6 | 80.6 | 73.4 |
| UNITED KINGDOM..... | 346.2 | 359.5 | 374.4 | 339.2 | 240.8 | 252.5 | 287.9 | 275.4 | 275.9 | 294.4 |
| U.S.A.............. | 4357.9 | 4556.8 | 4653.6 | 4488.8 | 3274.6 | 3353.2 | 4099.0 | 3499.7 | 3037.0 | 3343.0 |
| DEVELOPING COUNTRIES........... | 1305.8 | 1600.7 | 1807.8 | **1908.5** | **2080.3** | 2188.6 | **2500.3** | **2712.2** | 3019.1 | 3106.8 |
| AFRICA............. | 255.2 | 314.4 | 350.8 | 397.9 | 394.1 | 260.1 | 245.6 | 308.6 | 382.6 | 401.0 |
| CAMEROON........... | 41.3 | 44.5 | 43.1 | 65.4 | 78.9 | 77.4 | 73.1 | 81.6 | 81.1 | 71.5 |
| EGYPT.............. | 100.4 | 101.2 | 120.0 | 142.0 | 141.0 | 140.2 | 172.5 | 178.5 | 176.9 | 179.2 |
| GHANA.............. | 113.5 | 168.7 | 187.7 | 190.5 | 174.2 | 42.5 | 0.0 | 48.5 | 124.6 | 150.3 |
| AMERICA............ | 419.6 | 564.6 | 819.1 | 787.5 | 796.9 | 945.6 | **1045.8** | **1163.6** | **1395.0** | **1500.3** |
| ARGENTINA.......... | 49.5 | 118.4 | 133.1 | 133.9 | 140.5 | 136.4 | 137.8 | 139.9 | 150.6 | 155.1 |
| BRAZIL............. | 186.4 | 238.3 | 260.6 | 256.4 | 299.1 | 400.7 | 455.0 | 549.4 | 757.4 | 843.5 |
| MEXICO............. | 43.1 | 43.2 | 42.6 | 43.2 | 41.2 | 39.7 | 44.0 | 42.7 | 37.0 | 60.2 |
| SURINAM............ | 56.9 | 60.0 | 54.9 | 40.5 | 42.5 | 33.6 | 23.0 | 28.8 | 28.7 | 1.9 |
| VENEZUELA.......... | 83.7 | 204.7 | 327.9 | 313.5 | 273.6 | 335.2 | 386.0 | 402.8 | 421.3 | 439.6 |
| **ASIA...............** | **454.2** | **454.0** | 476.5 | **550.4** | **669.2** | **724.7** | **897.1** | **925.9** | **926.2** | **911.6** |
| BAHRAIN............ | 122.8 | 126.1 | 126.0 | 130.0 | 171.0 | 171.7 | 177.3 | 174.8 | 178.2 | 180.3 |
| INDIA.............. | 205.4 | 211.4 | 184.7 | 212.8 | 210.4 | 204.8 | 267.9 | 266.5 | 257.1 | 265.3 |
| INDONESIA.......... | 0.0 | 0.0 | 0.0 | 0.0 | 32.5 | 114.8 | 199.0 | 216.8 | 218.8 | 201.4 |
| IRAN............... | 25.5 | 11.0 | 15.9 | 12.5 | 45.0 | 39.2 | 42.4 | 43.0 | 40.0 | 45.0 |
| KOREA REP.......... | 17.7 | 17.5 | 17.8 | 17.5 | 15.2 | 12.6 | 17.2 | 17.5 | 17.3 | 21.7 |
| TAIWAN............. | 50.5 | 56.2 | 63.5 | 30.5 | 10.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TURKEY............. | 32.3 | 31.8 | 33.6 | 40.4 | 36.3 | 30.4 | 37.9 | 54.1 | 60.0 | 42.0 |
| U.A.EMIRAT......... | 0.0 | 0.0 | 35.0E | 106.7 | 148.7 | 151.2 | 155.4 | 153.2 | 154.8 | 155.9 |
| **EUROPE............** | **176.8** | **167.7** | **161.4** | **172.7** | **220.1** | **258.2** | **311.8** | **314.1** | **315.3** | **293.9** |
| YUGOSLAVIA......... | 176.8 | 167.7 | 161.4 | 172.7 | 220.1 | 258.2 | 311.8 | 314.1 | 315.3 | 293.9 |

Table A.5 : PRODUCTION OF PRIMARY ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| SOCIALIST COUNTRIES OF EASTERN EUROPE... | 2786.4E | 2832.4E | 2927.9E | 2875.0E | 2816.7E | 2836.9E | 2753.7E | 2777.5E | 2834.5E | 2844.4 |
| CZECHOSLOVAKIA..... | 36.8 | 36.9 | 38.3 | 32.7 | 33.8 | 36.2 | 31.6 | 31.7 | 33.1 | 32.4 |
| GERMAN DR.......... | 65.0 | 60.0 | 60.0 | 60.0 | 58.0 | 59.0 | 58.0 | 60.0 | 61.0 | 61.0 |
| HUNGARY............ | 71.4 | 71.9 | 73.5 | 74.3 | 74.2 | 74.0 | 74.2 | 73.8 | 73.9 | 73.5 |
| POLAND............. | 100.2 | 96.6 | 95.1 | 66.0 | 42.7 | 44.4 | 45.9 | 47.0 | 47.5 | 47.5 |
| ROMANIA............ | 213.0 | 217.0 | 241.0 | 242.0 | 208.0 | 223.3 | 244.0 | 265.0 | 269.0 | 260.0 |
| USSR............... | 2300.0E | 2350.0E | 2420.0E | 2400.0E | 2400.0E | 2400.0E | 2300.0E | 2300.0E | 2350.0E | 2370.0 |
| SOCIALIST COUNTRIES OF ASIA............ | 370.0 | 370.0 | 358.0 | 360.0 | 410.0 | 435.0 | 460.0 | 490.0 | 520.0 | 550.0 |
| CHINA.............. | 360.0 | 360.0 | 350.0 | 350.0 | 400.0 | 425.0 | 450.0 | 480.0 | 510.0 | 540.0 |
| KOREA DPR.......... | 10.0 | 10.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |

Table A.6 : EXPORTS OF BAUXITE

(Thousand metric tons gross weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 34495.2 | 34231.8 | 38551.1 | 34384.7 | 30143.2 | 29913.4 | 34884.3 | 32773.3 | 32007.8 | 32856.9 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 8229.5 | 8767.5 | 9718.8 | 7309.2 | 7049.9 | 5909.8 | 7268.5 | 7149.1 | 5856.2 | 5561.2 |
| AUSTRALIA.......... | 6422.1E | 6787.9E | 7230.6E | 5600.0E | 5420.0E | 4300.0E | 5500.0E | 5500.0E | 4500.0E | 3900.0E |
| BELGIUM........... | 0.7 | 4.5 | 1.8 | 0.6 | 1.2 | 1.7 | 1.7 | 2.0 | 2.9 | 2.4 |
| DENMARK........... | 41.6 | 52.0 | 46.5 | 20.6 | 2.4 | 0.4 | 3.1 | 2.0 | 0.0 | 0.0 |
| FRANCE............ | 17.4 | 12.5 | 10.8 | 6.6 | 92.4 | 68.6 | 245.2 | 200.7 | 116.1 | 187.4 |
| GERMANY, FED REP... | 12.3 | 21.6 | 21.7 | 21.1 | 30.7 | 40.6 | 43.4 | 41.4 | 25.1 | 32.4 |
| GREECE............ | 1688.7 | 1808.5 | 2340.2 | 1587.8 | 1441.2 | 1410.5 | 1374.1 | 1332.5 | 1133.5 | 1205.5 |
| IRELAND........... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| ITALY............. | 12.2 | 27.6 | 24.2 | 18.2 | 8.2 | 5.0 | 12.3 | 7.3 | 4.5 | 21.1 |
| JAPAN............. | 1.8 | 1.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.3 | 0.4 | 0.6 |
| NETHERLANDS........ | 3.3 | 26.3 | 13.4 | 12.5 | 4.3 | 3.5 | 5.5 | 5.1 | 4.0 | 9.3 |
| SWEDEN............ | 5.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 |
| UNITED KINGDOM..... | 0.5 | 1.4 | 1.2 | 0.9 | 0.8 | 0.7 | 0.9 | 1.4 | 0.6 | 1.0 |
| U.S.A............. | 23.2 | 23.5 | 28.4 | 40.9 | 48.7 | 74.1 | 82.2 | 56.1 | 69.1 | 201.5 |
| DEVELOPING COUNTRIES........... | 25578.0 | 24658.4 | 27838.7 | 26130.4 | 22285.9 | 23242.6 | 26664.8 | 24661.9 | 25312.5 | 26297.4 |
| AFRICA............ | 11384.2 | 10863.0 | 12197.0 | 10817.6 | 11141.9 | 12551.0 | 13462.7 | 14160.8 | 14426.0 | 15186.0 |
| GHANA............. | 293.2 | 203.0 | 223.0 | 151.0 | 36.0 | 81.0 | 44.0 | 124.0 | 226.0 | 195.0 |
| GUINEA............ | 10286.0 | 10019.0 | 11300.0 | 10057.0 | 10500.0E | 11520.0 | 12375.0E | 12950.0E | 13000.0E | 13600.0E |
| SIERRA LEONE....... | 805.0 | 641.0 | 674.0 | 609.6 | 605.9 | 950.0 | 1043.7 | 1086.8 | 1200.0 | 1391.0 |
| AMERICA........... | 12024.5E | 11663.0E | 13474.6E | 13223.7 | 9296.3 | 8673.6 | 11054.3 | 8629.0 | 9125.7 | 9515.0 |
| BRAZIL............ | 4.0 | 516.2 | 2679.4 | 4126.3 | 2991.3 | 3988.6 | 4320.0 | 3320.0 | 3113.2 | 3200.0 |
| DOMIN,REP.......... | 756.7 | 634.7 | 585.8 | 389.5 | 140.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| GUYANA............ | 1686.5 | 1713.8 | 1535.0 | 1427.6 | 1028.5 | 1061.0 | 1251.0 | 1530.0 | 1345.0 | 1315.0 |
| HAITI............. | 629.5 | 609.1 | 543.5 | 516.0 | 500.0E | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JAMAICA........... | 6447.8 | 6469.2 | 6145.9 | 5346.9 | 4074.1 | 3120.0 | 4368.0 | 2608.0E | 3680.0E | 4677.0E |
| SURINAM........... | 2500.0E | 1720.0E | 1985.0E | 1417.4 | 561.8 | 504.0 | 1115.3 | 1171.0 | 987.5 | 323.0 |
| ASIA.............. | 1493.2 | 1607.5 | 1920.3 | 1823.0 | 1244.0 | 1462.6 | 1495.8 | 1076.6 | 995.7 | 1011.7 |
| INDIA............. | 3.4 | 43.7 | 80.0 | 115.1 | 47.4 | 119.0 | 62.0 | 60.0E | 0.0 | 0.0 |
| INDONESIA.......... | 911.1 | 1091.0 | 1112.6 | 956.0 | 746.8 | 786.3 | 865.0 | 631.8 | 525.8 | 583.9 |
| MALAYSIA.......... | 550.0E | 470.2 | 718.3 | 642.5 | 418.1 | 500.0E | 522.0 | 362.1 | 412.6 | 323.3 |
| TURKEY............ | 28.7 | 2.6 | 9.4 | 109.4 | 31.7 | 57.3 | 46.8 | 22.7 | 57.3 | 104.5 |
| EUROPE............ | 676.1 | 524.9 | 246.8 | 266.1 | 603.7 | 555.4 | 652.0 | 795.5 | 765.1 | 584.7 |
| YUGOSLAVIA......... | 676.1 | 524.9 | 246.8 | 266.1 | 603.7 | 555.4 | 652.0 | 795.5 | 765.1 | 584.7 |
| SOCIALIST COUNTRIES OF EASTERN EUROPE... | 601.2 | 595.7 | 541.9 | 498.3 | 467.4 | 431.0 | 431.0 | 382.3 | 461.0 | 438.0 |
| HUNGARY........... | 601.2 | 595.7 | 541.9 | 498.3 | 467.4 | 431.0 | 431.0 | 382.3 | 461.0 | 438.0 |

Table A.6 : EXPORTS OF BAUXITE

(Thousand metric tons gross weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| SOCIALIST COUNTRIES OF ASIA............ | 86.5 | 210.2 | 451.7 | 446.8 | 340.0 | 330.0 | 520.0E | 580.0E | 378.1 | 560.3 |
| CHINA............. | 86.5 | 210.2 | 451.7 | 446.8 | 340.0 | 330.0 | 520.0E | 580.0E | 378.1 | 560.3 |

## Table A.7 : IMPORTS OF BAUXITE

(Thousand metric tons gross weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD.............. | 34507.2 | 34541.6 | 37668.8 | 34211.7 | 29468.4 | 28854.0 | 35088.3 | 32041.0 | 31040.1 | 32796.3 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 29283.9 | 29844.5 | 32653.8 | 29198.4 | 24297.9 | 21695.9 | 26456.0 | 23010.3 | 20638.7 | 22926.0 |
| AUSTRIA............ | 40.2 | 40.2 | 41.7 | 36.6 | 24.9 | 27.8 | 39.2 | 46.3 | 36.9 | 32.7 |
| BELGIUM............ | 32.9 | 40.9 | 35.9 | 33.1 | 26.6 | 34.8 | 40.5 | 36.7 | 29.1 | 26.5 |
| CANADA............. | 2432.6 | 2149.7 | 3504.4 | 2702.3 | 2574.7 | 2330.0 | 2451.5 | 2074.2 | 2112.9 | 2019.1 |
| DENMARK............ | 10.1 | 89.4 | 90.6 | 68.5 | 0.0 | 0.0 | 0.0 | 0.7 | 0.6 | 1.0 |
| FINLAND............ | 0.3 | 4.0 | 4.1 | 3.9 | 5.6 | 4.2 | 2.6 | 3.4 | 1.7 | 5.6 |
| FRANCE............. | 1954.5 | 1720.1 | 1358.1 | 1989.1 | 1253.1 | 1078.9 | 981.1 | 1002.8 | 910.8 | 894.3 |
| GERMANY, FED REP... | 3613.8 | 3694.2 | 4177.0 | 3910.6 | 3532.8 | 3156.1 | 4055.5 | 4034.0 | 3658.9 | 2879.4 |
| IRELAND............ | 0.0 | 0.0 | 0.0 | 0.0 | 111.7 | 563.0 | 1127.0 | 1322.3 | 1079.9 | 1440.1 |
| ISRAEL............. | 0.8 | 0.8E | 0.8E | 0.8E | 0.4E | 0.4E | 0.4E | 0.4E | 1.8E | 1.8E |
| ITALY.............. | 1644.7 | 2287.3 | 2288.3 | 1709.1 | 1578.1 | 1181.8 | 1281.3 | 1277.1 | 1396.0 | 1380.8 |
| JAPAN.............. | 4743.0 | 4597.1 | 5707.7 | 4352.4 | 3439.4 | 3579.7 | 3861.9 | 3519.0 | 2307.5 | 1872.1 |
| NETHERLANDS........ | 151.5 | 193.7 | 196.3 | 145.0 | 126.7 | 135.6 | 130.8 | 162.4 | 162.8 | 141.7 |
| NEW ZEALAND........ | 0.4 | 0.4 | 0.4 | 1.7 | 0.5 | 1.0 | 1.2 | 0.0 | 1.6 | 1.1 |
| NORWAY............. | 3.7 | 20.6 | 6.9 | 0.0 | 3.3 | 4.5 | 5.4 | 5.6 | 5.9 | 5.8 |
| PORTUGAL........... | 2.2 | 0.6 | 2.6 | 1.1 | 1.7 | 3.4 | 1.4 | 8.4 | 2.3 | 1.8 |
| SOUTH AFRICA....... | 18.1 | 23.7 | 24.7 | 15.3 | 27.0 | 17.2 | 20.0E | 19.5E | 20.0E | 30.0E |
| SPAIN.............. | 118.0 | 142.8 | 349.4 | 825.5 | 919.1 | 1464.6 | 1812.2 | 1589.5 | 1431.3 | 1662.7 |
| SWEDEN............. | 58.2 | 67.8 | 65.3 | 41.0 | 49.8 | 45.5 | 61.7 | 52.1 | 50.1 | 46.4 |
| SWITZERLAND........ | 7.7 | 7.0 | 5.5 | 0.8 | 0.4 | 1.3 | 2.4 | 0.0 | 0.0 | 0.0 |
| UNITED KINGDOM..... | 321.4 | 284.0 | 267.6 | 240.6 | 310.1 | 256.1 | 316.9 | 257.5 | 270.8 | 325.4 |
| U.S.A.............. | 14129.8 | 14480.2 | 14526.5 | 13121.0 | 10312.0 | 7810.0 | 10263.0 | 7598.4 | 7157.8 | 10157.7 |
| DEVELOPING COUNTRIES........... | 336.0 | 501.6 | 678.3 | 730.6 | 505.5 | 2141.0 | 3032.7 | 3003.4 | 3475.0 | 3623.5 |
| AFRICA............. | 0.8 | 0.8 | 0.5 | 7.9 | 8.6 | 2.0 | 4.9 | 29.3 | 5.1 | 4.6 |
| ALGERIA............ | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| EGYPT.............. | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.7 | 26.1 | 1.1 | 0.0 |
| MOROCCO............ | 0.8 | 0.8 | 0.5 | 6.9 | 8.1 | 2.0 | 3.2 | 3.2 | 4.0 | 4.6 |
| AMERICA............ | 93.4 | 177.7 | 172.0 | 133.7 | 154.1 | 1790.8 | 2625.3 | 2500.5 | 2929.2 | 3114.2 |
| ARGENTINA.......... | 18.5 | 21.6 | 18.5 | 6.1 | 24.6 | 23.8 | 25.2 | 23.7 | 25.7 | 31.3 |
| BRAZIL............. | 10.1 | 15.6 | 13.2 | 15.0 | 8.6 | 5.0 | 11.2 | 8.8 | 1.0 | 3.0 |
| CHILE.............. | 1.0E | 1.0E | 1.0E | 0.5E | 0.5E | 0.5E | 2.7 | 2.5 | 2.3 | 2.0E |
| COLOMBIA........... | 1.2 | 4.7 | 3.8 | 5.9 | 3.0 | 5.8 | 4.1 | 8.7 | 5.8 | 5.0E |
| MEXICO............. | 50.7 | 61.6 | 90.1 | 63.9 | 43.3 | 26.7 | 52.0 | 46.7 | 35.0 | 40.3 |
| PERU............... | 4.9 | 5.0 | 6.7 | 5.5 | 3.7 | 6.5 | 5.9 | 4.0E | 0.3 | 0.2E |
| URUGUAY............ | 1.0 | 1.5 | 4.4 | 4.1 | 3.4 | 3.3 | 2.0 | 1.9 | 4.0 | 8.5 |
| VENEZUELA.......... | 6.0 | 66.7 | 34.3 | 32.7 | 67.0 | 1719.2 | 2522.2 | 2404.2 | 2855.1 | 3023.9 |
| ASIA............... | 198.2 | 259.3 | 288.2 | 194.8 | 165.4 | 189.4 | 216.7 | 310.6E | 356.0E | 371.9 |
| HONG KONG.......... | 7.1 | 9.4 | 15.1 | 11.6 | 10.2 | 17.5 | 23.6 | 18.8 | 20.6 | 25.8 |
| INDONESIA.......... | 0.3 | 0.5 | 0.9 | 0.1 | 0.0 | 0.1 | 0.2 | 0.1 | 0.0 | 0.0 |
| KOREA REP.......... | 2.0 | 1.9 | 2.2 | 4.9 | 5.3 | 6.1 | 9.3 | 9.2 | 15.6 | 30.4 |
| MALAYSIA........... | 0.5 | 0.8 | 0.8 | 1.5 | 0.5 | 0.5E | 1.2 | 1.0 | 1.3 | 2.8 |
| PHILIPP............ | 4.1 | 9.9 | 8.2 | 12.6 | 3.8 | 3.1 | 3.6 | 5.0 | 5.4 | 5.0E |

Table A.7 : IMPORTS OF BAUXITE

(Thousand metric tons gross weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAUDI ARABIA....... | 0.0 | 0.0 | 0.0 | 39.5 | 114.9 | 142.7 | 163.6 | 244.1 | 250.0E | 250.0E |
| SINGAPORE.......... | 7.2 | 11.0 | 0.4 | 0.0 | 0.0 | 0.3 | 0.1 | 0.4 | 0.0 | 0.0 |
| TAIWAN............. | 171.2 | 209.8 | 260.4 | 106.7 | 30.4 | 0.0E | 0.0E | 19.5 | 47.3 | 36.2 |
| THAILAND........... | 5.8 | 3.4 | 0.2 | 8.9 | 0.3 | 0.4 | 6.6 | 7.5 | 10.8 | 21.7 |
| U.A.EMIRAT......... | 0.0 | 12.6 | 0.0 | 9.0 | 0.0 | 18.7 | 8.5 | 5.0E | 5.0E | 0.0 |
| **EUROPE.............** | **43.6** | **63.8** | **217.6** | **394.2** | **177.4** | **158.8** | **185.8** | **163.0** | **184.7** | **132.8** |
| YUGOSLAVIA......... | 43.6 | 63.8 | 217.6 | 394.2 | 177.4 | 158.8 | 185.8 | 163.0 | 184.7 | 132.8 |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF EASTERN EUROPE...** | **4887.3E** | **4195.5E** | **4336.7E** | **4282.7E** | **4665.0E** | **5017.1E** | **5599.6E** | **6027.3E** | **6926.4E** | **6246.8E** |
| CZECHOSLOVAKIA..... | 456.0 | 472.0 | 466.0 | 454.0 | 474.0 | 469.0 | 349.0 | 356.0 | 399.0 | 453.0 |
| GERMAN DR.......... | 251.5 | 133.8 | 120.6 | 67.2 | 109.9 | 103.7 | 170.6 | 208.4 | 178.1 | 141.6 |
| POLAND............. | 100.6 | 95.1 | 83.1 | 39.5 | 41.0 | 34.4 | 40.0E | 37.9 | 49.3 | 52.2 |
| ROMANIA............ | 877.2 | 668.6 | 1051.0 | 436.0 | 580.5 | 520.0E | 500.0E | 600.0E | 600.0E | 600.0E |
| USSR............... | 3202.0E | 2826.0E | 2616.0E | 3286.0E | 3459.6E | 3890.0E | 4540.0E | 4825.0E | 5700.0E | 5000.0E |

## Table A.8 : EXPORTS OF ALUMINA

(Thousand metric tons actual weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 13832.0 | 14597.6 | 15840.8 | 14894.8 | 12612.2 | 13733.4 | 15433.8 | 15483.8 | 16090.4 | 17385.2 |
| | | | | | | | | | | |
| **DEVELOPED MARKET ECONOMY COUNTRIES...** | 8807.6 | 9193.8 | 9821.4 | 8946.4 | 8046.8 | 8735.4 | 10382.0 | 10084.6 | 10607.6 | 12336.4 |
| AUSTRALIA......... | 6374.0E | 6600.0 | 7000.0 | 6509.2 | 5973.0 | 6378.2 | 6923.6 | 7158.0 | 7698.6 | 8303.8 |
| BELGIUM........... | 0.2 | 1.2 | 0.8 | 0.6 | 0.4 | 0.8 | 0.8 | 1.0 | 1.2 | 1.2 |
| CANADA............ | 32.6 | 25.6 | 39.6 | 43.6 | 28.4 | 45.0 | 50.6 | 52.8 | 45.4 | 45.6 |
| DENMARK........... | 0.2 | 0.2 | 0.2 | 0.6 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| FRANCE............ | 303.0 | 335.0 | 346.8 | 238.8 | 281.0 | 269.8 | 232.2 | 300.0 | 194.4 | 195.4 |
| GERMANY, FED REP... | 465.2 | 379.0 | 401.8 | 508.2 | 362.4 | 468.0 | 629.0 | 599.8 | 496.6 | 491.2 |
| GREECE............ | 174.4 | 267.0 | 203.2 | 159.0 | 130.0 | 110.4 | 208.4 | 187.4 | 135.6 | 348.8 |
| IRELAND........... | 1.8 | 1.6 | 1.8 | 1.8 | 2.4 | 31.6 | 654.0 | 572.0 | 669.4 | 741.6 |
| ITALY............. | 327.6 | 418.0 | 424.0 | 231.2 | 270.0 | 174.4 | 325.2 | 283.4 | 338.4 | 590.8 |
| JAPAN............. | 175.0 | 259.6 | 440.6 | 412.0 | 339.8 | 569.2 | 573.0 | 481.6 | 384.4 | 197.8 |
| NETHERLANDS........ | 39.6 | 60.0 | 52.0 | 40.4 | 47.0 | 51.8 | 65.0 | 59.4 | 46.6 | 62.0 |
| NORWAY............ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.8 | 12.6 | 17.8 |
| SPAIN............. | 0.0 | 0.0 | 0.0 | 24.0 | 7.4 | 2.6 | 20.8 | 16.6 | 42.8 | 159.8 |
| SWITZERLAND........ | 0.2 | 1.0 | 1.2 | 0.6 | 0.4 | 0.2 | 0.2 | 1.4 | 0.6 | 0.6 |
| UNITED KINGDOM..... | 36.2 | 33.6 | 42.8 | 39.6 | 37.0 | 37.8 | 44.0 | 45.2 | 46.8 | 42.4 |
| U.S.A............. | 877.6 | 812.0 | 866.6 | 736.8 | 567.4 | 595.4 | 654.8 | 325.0 | 494.0 | 1137.4 |
| | | | | | | | | | | |
| **DEVELOPING COUNTRIES...........** | 4317.4 | 4688.8 | 5296.6 | 5292.0 | 3993.0 | 4339.8 | 4406.8 | 4800.2 | 4811.8 | 4373.6 |
| **AFRICA.............** | 610.0 | 654.0 | 716.0 | 680.0 | 580.0E | 660.0E | 700.0E | 810.0E | 600.0E | 560.0E |
| GUINEA............. | 510.0 | 654.0 | 716.0 | 680.0 | 580.0E | 560.0E | 700.0E | 810.0E | 600.0E | 560.0E |
| **AMERICA............** | 3566.4 | 3507.2 | 3985.8 | 3923.0 | 2849.2 | 3106.2 | 3220.4 | 3485.2 | 3541.4 | 3303.0 |
| BRAZIL............ | 0.8 | 0.4 | 0.2 | 0.6 | 5.0 | 7.0 | 43.2 | 94.2 | 77.2 | 87.0 |
| GUYANA............ | 251.2 | 145.6 | 231.0 | 153.0 | 64.6 | 23.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| JAMAICA........... | 2140.0 | 2128.0 | 2361.0 | 2547.2 | 1673.6 | 1816.0 | 1680.0 | 1610.0 | 1562.0 | 1444.0 |
| SURINAM........... | 1174.4E | 1233.2E | 1393.6E | 1222.2 | 1106.0 | 1198.0 | 1148.0 | 1326.0 | 1406.0 | 1342.0 |
| VENEZUELA......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 62.0 | 349.2 | 455.0 | 496.2 | 430.0 |
| **ASIA.............** | 39.0 | 63.8 | 154.8 | 72.6 | 57.4E | 58.0E | 66.8 | 72.6 | 88.0 | 91.8 |
| INDIA............. | 18.0E | 62.4 | 80.2 | 9.6 | 37.4 | 38.0 | 50.0 | 50.0E | 64.0E | 74.0 |
| TURKEY............ | 21.0 | 1.4 | 74.6 | 63.0 | 20.0E | 20.0E | 16.8 | 22.6 | 24.0 | 17.8 |
| **EUROPE...........** | 102.0 | 463.8 | 440.0 | 616.4 | 506.4 | 515.6 | 419.6 | 432.4 | 582.4 | 418.8 |
| YUGOSLAVIA........ | 102.0 | 463.8 | 440.0 | 616.4 | 506.4 | 515.6 | 419.6 | 432.4 | 582.4 | 418.8 |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF EASTERN EUROPE...** | 697.0 | 701.4 | 694.0 | 626.4 | 542.4 | 657.8 | 644.0 | 594.0 | 665.0 | 665.2 |
| HUNGARY........... | 697.0 | 701.4 | 694.0 | 626.4 | 542.4 | 657.8 | 644.0 | 594.0 | 665.0 | 665.2 |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF ASIA............** | 10.0 | 13.6 | 28.8 | 30.0 | 30.0E | 0.4E | 1.0E | 5.0E | 6.0E | 10.0E |

Table A.8 : EXPORTS OF ALUMINA

(Thousand metric tons actual weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| CHINA.............. | 10.0 | 13.6 | 28.8 | 30.0 | 30.0E | 0.4E | 1.0E | 5.0E | 6.0E | 10.0E |

Table A.9 : IMPORTS OF ALUMINA

(Thousand metric tons actual weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD | 13603.2 | 14130.6 | 15437.4 | 14608.6 | 12505.6 | 13835.6 | 15111.8 | 15117.8 | 15744.8 | 16738.6 |
| DEVELOPED MARKET ECONOMY COUNTRIES | 10766.2 | 10656.0 | 11577.6 | 10419.4 | 8408.2 | 9979.2 | 11277.2 | 11023.4 | 10996.4 | 12320.8 |
| AUSTRIA | 206.6 | 200.4 | 232.4 | 274.4 | 220.0 | 217.8 | 250.6 | 303.6 | 276.0 | 284.0 |
| AUSTRALIA | 6.6 | 8.4 | 7.4 | 7.0 | 7.2 | 5.4 | 7.6 | 5.0 | 5.0 | 10.4 |
| BELGIUM | 21.8 | 24.0 | 21.6 | 23.6 | 22.8 | 26.6 | 28.2 | 28.0 | 29.0 | 33.0 |
| CANADA | 1056.2 | 953.0 | 984.0 | 1034.0 | 949.8 | 1075.2 | 1365.6 | 1561.0 | 1744.0 | 2095.6 |
| DENMARK | 4.4 | 3.2 | 4.0 | 5.2 | 3.6 | 4.0 | 4.2 | 4.4 | 4.6 | 5.0 |
| FINLAND | 24.4 | 28.0 | 29.4 | 31.4 | 27.8 | 20.6 | 27.4 | 29.4 | 30.2 | 33.6 |
| FRANCE | 55.8 | 38.2 | 44.6 | 34.0 | 80.2 | 91.2 | 50.0 | 139.0 | 124.6 | 145.8 |
| GERMANY, FED REP | 488.2 | 459.8 | 442.2 | 470.4 | 492.2 | 488.6 | 702.0 | 664.8 | 721.8 | 865.0 |
| GREECE | 0.2 | 0.6 | 0.2 | 0.4 | 0.4 | 0.4 | 0.6 | 0.6 | 0.6 | 0.6 |
| ICELAND | 141.8 | 142.0 | 146.0 | 134.2 | 117.4 | 144.4 | 147.6 | 197.2 | 138.0 | 142.4 |
| IRELAND | 3.2 | 3.6 | 4.0 | 4.2 | 4.0 | 13.2 | 3.2 | 4.8 | 4.4 | 4.2 |
| ISRAEL | 1.0 | 3.6 | 4.0 | 3.6E | 3.4E | 3.6E | 3.8E | 4.2E | 3.4E | 3.0E |
| ITALY | 166.8 | 179.8 | 180.2 | 169.8 | 75.6 | 305.6 | 271.8 | 291.4 | 377.0 | 336.6 |
| JAPAN | 758.8 | 776.0 | 734.8 | 640.4 | 155.8 | 35.2 | 143.0 | 46.4 | 63.6 | 42.0 |
| NETHERLANDS | 567.4 | 587.6 | 604.0 | 622.6 | 592.2 | 531.4 | 598.2 | 589.2 | 641.6 | 647.2 |
| NEW ZEALAND | 299.2 | 337.0 | 281.4 | 303.0 | 345.4 | 448.6 | 465.2 | 503.2 | 445.8 | 507.8 |
| NORWAY | 1229.4 | 1200.6 | 1479.4 | 1242.8 | 1137.0 | 1433.6 | 1490.8 | 1479.2 | 1495.8 | 1644.6 |
| PORTUGAL | 6.8 | 6.2 | 4.6 | 8.4 | 7.6 | 6.6 | 6.4 | 6.2 | 8.2 | 8.0 |
| SOUTH AFRICA | 168.0E | 170.0E | 164.6 | 180.0 | 278.0 | 360.6 | 317.4 | 330.0E | 340.0E | 350.0E |
| SPAIN | 432.2 | 559.2 | 706.6 | 228.8 | 37.2 | 21.2 | 23.0 | 25.2 | 22.4 | 27.4 |
| SWEDEN | 185.2 | 200.0 | 191.8 | 215.6 | 204.6 | 202.8 | 251.2 | 242.8 | 187.6 | 271.0 |
| SWITZERLAND | 152.8 | 144.8 | 174.0 | 171.6 | 135.4 | 149.2 | 162.2 | 160.4 | 160.4 | 156.4 |
| UNITED KINGDOM | 699.4 | 610.0 | 779.0 | 636.2 | 457.0 | 488.8 | 662.0 | 572.8 | 559.0 | 629.2 |
| U.S.A. | 4090.0 | 4020.0 | 4357.4 | 3977.8 | 3053.6 | 3904.6 | 4295.2 | 3834.6 | 3613.4 | 4078.0 |
| DEVELOPING COUNTRIES | 1333.8 | 1867.6 | 2168.6 | 2695.2 | 2728.6 | 2434.0 | 2494.0 | 2456.2 | 2985.2 | 3056.8 |
| AFRICA | 510.6E | 633.0E | 730.6E | 845.4E | 732.4E | 549.0E | 515.4E | 628.2E | 791.4E | 847.2E |
| ALGERIA | 1.4 | 0.0 | 1.2 | 0.4 | 0.0 | 1.2 | 1.6 | 0.4 | 0.8 | 0.2 |
| CAMEROON | 81.6 | 67.4 | 86.8 | 155.0 | 73.8 | 154.2 | 146.0 | 164.0 | 150.8 | 162.0 |
| EGYPT | 180.0E | 200.0E | 240.0E | 280.0E | 280.0E | 280.0E | 340.0E | 340.0E | 360.0E | 360.0E |
| GHANA | 226.0E | 338.0 | 376.0E | 382.0E | 350.0E | 86.0E | 0.0E | 100.0E | 250.0 | 300.0E |
| KENYA | 0.2E | 0.4E | 1.0 | 5.6 | 1.6 | 1.6E | 1.6E | 1.0E | 1.0E | 1.0 |
| MOROCCO | 1.8 | 1.8 | 2.4 | 2.0 | 2.4 | 2.8 | 2.0 | 2.2 | 2.0 | 2.8 |
| TUNISIA | 19.6 | 25.4 | 23.2 | 20.4 | 24.6 | 23.2 | 24.2 | 20.6 | 26.8 | 21.2 |
| AMERICA | 376.2 | 783.4 | 914.0 | 1113.8 | 1106.0E | 815.6 | 643.8 | 587.2 | 767.2 | 830.4 |
| ARGENTINA | 87.0 | 229.6 | 251.8 | 295.8 | 261.6 | 214.6 | 322.6 | 303.4 | 356.8 | 239.2 |
| BRAZIL | 24.4 | 70.6 | 64.2 | 26.8 | 87.0 | 202.8 | 183.8 | 136.6E | 285.6 | 393.4 |
| CHILE | 1.6 | 1.2 | 1.0 | 1.2 | 0.0 | 0.2 | 0.2 | 0.6 | 0.4 | 0.4 |
| COLOMBIA | 0.6 | 0.6 | 0.8 | 0.8 | 1.6 | 2.2 | 4.4 | 3.6 | 3.6 | 2.0 |
| ECUADOR | 0.4 | 0.4 | 2.4 | 0.4 | 3.2 | 3.2E | 3.2E | 3.4E | 2.0E | 1.0 |
| MEXICO | 108.8 | 93.4 | 86.0E | 90.0E | 105.4 | 121.2 | 120.8 | 131.0 | 110.6 | 183.6 |
| PERU | 1.4 | 2.6 | 2.6 | 1.2 | 0.6 | 0.6E | 0.6 | 0.6E | 0.6E | 0.6 |

Table A.9 : IMPORTS OF ALUMINA

(Thousand metric tons actual weight)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| URUGUAY............ | 1.0 | 1.2 | 1.4 | 1.0 | 0.6 | 0.6 | 0.6 | 0.6E | 1.2 | 1.2 |
| VENEZUELA.......... | 151.0 | 383.8 | 503.8 | 696.6 | 646.0E | 270.2 | 7.6 | 7.4 | 6.4 | 9.0 |
| **ASIA...............** | **417.0** | **449.8** | **522.6** | **675.4** | **856.4** | **968.0** | **1221.6** | **1122.4** | **1275.0** | **1260.8** |
| BAHRAIN............ | 244.0E | 252.0E | 234.8 | 282.0E | 342.0E | 344.0E | 350.0E | 350.0E | 360.0E | 360.0E |
| HONG KONG.......... | 3.0 | 1.6 | 3.0 | 2.2 | 3.8 | 2.4 | 0.4 | 32.8 | 0.0 | 1.0 |
| INDONESIA.......... | 22.0 | 14.4 | 19.4 | 39.8 | 66.2 | 182.4 | 398.8 | 225.6 | 303.6 | 263.0 |
| IRAN............... | 40.0E | 20.0E | 30.0E | 30.0E | 60.0E | 50.0E | 54.0E | 50.0E | 60.0E | 80.0E |
| JORDAN............. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.0 | 4.4 | 0.4 | 12.0 |
| KOREA REP.......... | 52.4 | 63.4 | 59.4 | 65.8 | 29.0 | 69.8 | 77.8 | 77.6 | 93.4 | 107.0 |
| MALAYSIA........... | 4.0E | 10.2 | 6.8 | 5.4 | 3.2 | 5.8 | 7.0 | 5.4 | 12.2 | 11.6 |
| PAKISTAN........... | 0.0 | 0.0 | 0.2 | 0.0 | 2.8 | 1.4 | 2.0 | 1.8 | 3.0 | 2.0E |
| PHILIPP............ | 0.6 | 3.8 | 1.2 | 1.4 | 0.6 | 2.0 | 2.8 | 3.6 | 5.4 | 5.0E |
| SAUDI ARABIA....... | 0.2 | 0.0 | 1.2 | 5.6 | 0.6 | 0.4 | 2.0 | 2.0E | 2.0E | 2.0 |
| SINGAPORE.......... | 4.0 | 7.6 | 8.2 | 6.6 | 10.8 | 9.6 | 9.2 | 48.8 | 103.2 | 75.2 |
| SRI LANKA.......... | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 1.0 | 0.6 | 0.6E | 0.6E | 0.6 |
| TAIWAN............. | 42.6 | 67.6 | 59.0 | 39.4 | 20.0 | 8.0E | 7.0E | 5.8 | 2.2 | 0.0 |
| THAILAND........... | 4.0 | 8.8 | 13.0 | 10.0 | 11.8 | 11.4 | 10.8 | 13.4 | 17.6 | 20.0 |
| TURKEY............. | 0.2 | 0.2 | 0.0 | 0.2 | 0.4 | 0.2 | 0.2 | 0.6 | 1.4 | 1.4 |
| U.A.EMIRAT......... | 0.0 | 0.0 | 86.4 | 187.0 | 305.0 | 279.6 | 290.0E | 300.0E | 310.0E | 320.0E |
| **EUROPE.............** | **30.0** | **1.4** | **1.4** | **60.6** | **33.8** | **101.4** | **113.2** | **118.4** | **151.6** | **118.4** |
| YUGOSLAVIA......... | 30.0 | 1.4 | 1.4 | 60.6 | 33.8 | 101.4 | 113.2 | 118.4 | 151.6 | 118.4 |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF EASTERN EUROPE...** | **1503.2E** | **1607.0E** | **1691.2E** | **1494.0E** | **1338.8E** | **1328.4E** | **1246.6E** | **1606.6E** | **1735.2E** | **1335.0E** |
| CZECHOSLOVAKIA..... | 22.0E | 24.0E | 24.0E | 24.0E | 24.0E | 24.0E | 17.6E | 16.0E | 10.0E | 14.0E |
| GERMAN DR.......... | 90.0E | 90.0E | 90.0E | 90.0E | 90.0E | 90.0E | 90.0E | 80.0E | 80.0E | 80.0E |
| POLAND............. | 311.2 | 283.0 | 287.2 | 240.0 | 208.0 | 210.4 | 135.0E | 206.6 | 225.2 | 221.0 |
| ROMANIA............ | 80.0E | 90.0E | 90.0E | 40.0E | 6.0E | 4.0E | 4.0E | 4.0E | 20.0E | 20.0E |
| USSR............... | 1000.0E | 1120.0E | 1200.0E | 1100.0E | 1010.8E | 1000.0E | 1000.0E | 1300.0E | 1400.0E | 1000.0E |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF ASIA.............** | **0.0** | **0.0** | **0.0** | **0.0** | **30.0** | **94.0** | **94.0** | **31.6** | **28.0E** | **26.0E** |
| CHINA.............. | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | 73.6 | 70.0 | 8.4 | 8.0E | 6.0E |
| KOREA DPR.......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.4 | 24.0 | 23.2 | 20.0E | 20.0E |

Table A.10 : EXPORTS OF UNWROUGHT ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 4336.5 | 4116.3 | 4893.5 | 4795.8 | 5327.5 | 6153.3 | 5892.2 | 6633.7 | 6614.4 | 7335.6 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 3161.0 | 2823.4 | 3462.5 | 3243.1 | 3529.8 | 4037.0 | 3840.6 | 4307.7 | 4247.4 | 4680.6 |
| AUSTRIA............ | 11.7 | 10.3 | 9.8 | 25.0 | 27.6 | 30.1 | 28.8 | 31.1 | 31.3 | 39.4 |
| AUSTRALIA.......... | 80.0 | 76.0 | 45.9 | 79.2 | 156.6 | 238.7 | 413.5 | 564.9 | 582.5 | 715.3 |
| BELGIUM............ | 10.2 | 10.8 | 19.6 | 29.7 | 13.7 | 17.0 | 10.3 | 23.0 | 24.9 | 27.6 |
| CANADA............. | 862.6 | 550.5 | 784.7 | 726.1 | 896.5 | 925.5 | 834.4 | 1050.8 | 1163.9 | 1171.9 |
| DENMARK............ | 9.8 | 10.0 | 7.0 | 7.6 | 8.3 | 9.0 | 9.7 | 12.2 | 10.2 | 12.7 |
| FINLAND............ | 2.7 | 1.3 | 3.9 | 4.6 | 6.3 | 10.7 | 13.6 | 16.2 | 17.0 | 24.3 |
| FRANCE............. | 166.5 | 157.6 | 177.4 | 190.5 | 182.7 | 160.7 | 146.6 | 115.4 | 143.3 | 119.3 |
| GERMANY, FED REP... | 271.6 | 247.9 | 223.7 | 253.0 | 255.4 | 317.1 | 293.9 | 278.5 | 300.9 | 332.0 |
| GREECE............. | 85.3 | 73.8 | 60.2 | 69.2 | 66.6 | 55.1 | 48.4 | 43.2 | 45.9 | 71.8 |
| ICELAND............ | 77.3 | 76.2 | 67.3 | 63.2 | 61.5 | 106.9 | 79.9 | 70.6 | 77.5 | 89.1 |
| IRELAND............ | 2.3 | 2.5 | 2.2 | 2.2 | 1.9 | 2.5 | 1.1 | 0.6 | 1.5 | 1.5 |
| ISRAEL............. | 1.0 | 2.1 | 3.1 | 2.5 | 0.9 | 1.8 | 5.3 | 5.5 | 3.6 | 3.6E |
| ITALY.............. | 69.3 | 22.4 | 11.8 | 49.8 | 54.1 | 41.3 | 32.2 | 43.8 | 34.3 | 51.6 |
| JAPAN.............. | 54.6 | 8.0 | 7.7 | 12.2 | 6.7 | 1.7 | 2.3 | 2.2 | 2.0 | 1.9 |
| NETHERLANDS........ | 294.4 | 359.4 | 365.3 | 352.0 | 350.8 | 433.3 | 279.0 | 296.8 | 301.3 | 314.4 |
| NEW ZEALAND........ | 141.3 | 120.0 | 126.2 | 122.5 | 151.4 | 182.1 | 208.9 | 235.6 | 200.0 | 227.7 |
| NORWAY............. | 630.2 | 565.3 | 521.2 | 524.0 | 545.4 | 637.4 | 638.7 | 643.8 | 646.5 | 754.2 |
| PORTUGAL........... | 0.2 | 1.0 | 0.3 | 0.4 | 0.5 | 0.3 | 0.8 | 2.0 | 0.0 | 2.1 |
| SOUTH AFRICA....... | 37.4 | 29.4 | 12.6 | 3.3 | 26.0 | 110.8 | 82.7 | 93.0 | 94.0 | 93.8 |
| SPAIN.............. | 5.8 | 42.9 | 106.8 | 162.7 | 145.2 | 165.9 | 231.2 | 208.4 | 146.4 | 107.0 |
| SWEDEN............. | 38.5 | 19.6 | 17.7 | 37.7 | 35.2 | 39.2 | 38.2 | 41.8 | 39.4 | 43.6 |
| SWITZERLAND........ | 32.9 | 47.4 | 45.0 | 45.0 | 53.0 | 56.8 | 53.9 | 49.6 | 54.6 | 61.0 |
| UNITED KINGDOM..... | 160.5 | 207.0 | 194.5 | 168.5 | 119.5 | 132.4 | 127.6 | 129.1 | 116.8 | 133.6 |
| U.S.A.............. | 114.9 | 182.0 | 648.6 | 312.2 | 364.0 | 360.7 | 259.6 | 349.6 | 209.6 | 281.2 |
| DEVELOPING COUNTRIES........... | 496.5 | 605.3 | 688.6 | 808.7 | 1040.7 | 1265.6 | 1176.5 | 1487.0 | 1580.0 | 1732.1 |
| AFRICA............. | 186.3 | 232.4 | 219.0 | 234.2 | 284.9 | 186.7E | 193.5E | 187.5E | 259.4E | 286.0 |
| CAMEROON........... | 7.2 | 30.5 | 9.7 | 23.4 | 59.0 | 52.4 | 54.3 | 51.9 | 39.0 | 39.4 |
| EGYPT.............. | 67.8 | 49.3 | 43.1 | 76.5 | 51.7 | 52.0E | 95.0E | 115.0E | 116.0E | 106.6 |
| GHANA.............. | 111.3 | 152.6 | 166.2 | 134.3 | 174.2 | 82.3 | 44.2 | 20.6 | 104.4 | 140.0 |
| AMERICA............ | 79.6 | 195.6 | 330.1 | 350.2 | 355.9 | 501.8 | 449.1 | 686.6 | 705.2 | 813.0 |
| ARGENTINA.......... | 7.6 | 29.4 | 66.8 | 82.2 | 83.1 | 53.8 | 53.1 | 98.1 | 74.0 | 73.0 |
| BRAZIL............. | 0.0 | 0.0 | 0.0 | 2.2 | 3.7 | 116.3 | 148.2 | 177.2 | 323.5 | 430.9 |
| MEXICO............. | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 0.6 | 0.8 | 0.0 | 0.0 | 3.1 |
| SURINAM............ | 55.0 | 63.5 | 54.2 | 31.6 | 60.3 | 38.9 | 22.2 | 28.4 | 29.8 | 3.2 |
| VENEZUELA.......... | 17.0 | 102.7 | 209.1 | 233.9 | 208.6 | 292.2 | 224.8 | 382.9 | 277.9 | 302.8 |
| ASIA............... | 171.9 | 131.1 | 85.6 | 165.8E | 308.9 | 433.5 | 391.9 | 470.2 | 473.2 | 475.9 |
| BAHRAIN............ | 167.6 | 130.2 | 77.6 | 82.8 | 166.0 | 191.6 | 109.8 | 74.3 | 130.2 | 146.1 |
| INDIA.............. | 2.9 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| INDONESIA.......... | 0.0 | 0.0 | 0.0 | 0.0 | 16.0 | 90.7 | 135.0 | 238.7 | 174.1 | 163.3 |
| IRAN............... | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| KOREA REP.......... | 0.8 | 0.6 | 1.5 | 0.9 | 0.0 | 0.2 | 0.2 | 0.7 | 0.8 | 2.9 |

## Table A.10 : EXPORTS OF UNWROUGHT ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAIWAN............. | 0.4 | 0.0 | 0.0 | 0.0 | 0.6 | 2.6 | 3.1 | 5.8 | 12.5 | 17.3 |
| TURKEY............. | 0.0 | 0.0 | 0.0 | 0.0E | 1.0 | 1.2 | 0.0 | 0.0 | 0.0 | 0.3 |
| U.A.EMIRAT......... | 0.0 | 0.0 | 6.4 | 82.1 | 125.3 | 147.2 | 143.8 | 150.7 | 155.6 | 146.0 |
| **EUROPE.............** | **58.7** | **46.2** | **53.9** | **58.5** | **91.0** | **143.6** | **142.0** | **142.7** | **142.2** | **157.2** |
| YUGOSLAVIA......... | 58.7 | 46.2 | 53.9 | 58.5 | 91.0 | 143.6 | 142.0 | 142.7 | 142.2 | 157.2 |
| **SOCIALIST COUNTRIES OF EASTERN EUROPE...** | **679.0E** | **684.9E** | **736.5E** | **707.7E** | **712.6E** | **837.6E** | **868.9E** | **824.6E** | **769.5E** | **862.7E** |
| BULGARIA........... | 6.3 | 6.6 | 6.2 | 3.7 | 3.6 | 6.0 | 5.3 | 3.9 | 3.9 | 3.5 |
| CZECHOSLOVAKIA..... | 18.6 | 16.6 | 10.1 | 8.4 | 15.0 | 21.4 | 18.0 | 22.0 | 16.0E | 12.2E |
| GERMAN DR.......... | 23.8 | 26.2 | 22.5 | 25.4 | 26.2 | 25.7 | 30.0 | 23.0 | 25.0E | 29.0E |
| HUNGARY............ | 77.8 | 80.6 | 84.2 | 85.7 | 48.4 | 57.8 | 71.3 | 50.5 | 61.2 | 63.4 |
| POLAND............. | 12.2 | 4.9 | 19.7 | 6.3 | 3.3 | 8.1 | 4.9 | 6.1 | 3.4 | 2.6 |
| ROMANIA............ | 70.3 | 65.0 | 93.8 | 98.2 | 76.1 | 121.6 | 122.4 | 139.1 | 140.0E | 140.0E |
| USSR............... | 470.0E | 485.0E | 500.0E | 480.0E | 540.0E | 597.0E | 617.0E | 580.0E | 520.0E | 612.0E |
| **SOCIALIST COUNTRIES OF ASIA.............** | **0.0** | **2.7** | **5.9** | **36.3** | **44.4** | **13.1** | **6.2** | **14.4** | **17.5** | **60.2** |
| CHINA.............. | 0.0 | 2.7 | 5.9 | 36.3 | 44.4 | 13.1 | 6.0 | 5.7 | 6.1 | 53.2 |
| KOREA DPR.......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 8.7 | 11.4 | 7.0 |

Table A.11 : IMPORTS OF UNWROUGHT ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD.............. | 4375.5 | 4367.2 | 4892.5 | 4713.3 | 5478.9 | 6234.3 | 6094.0 | 6732.5 | 7051.9 | 7340.7 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 3150.6 | 3155.4 | 3562.2 | 3565.9 | 4132.1 | 4647.7 | 4576.7 | 4865.3 | 5372.9 | 5680.5 |
| AUSTRIA........... | 14.9 | 30.7 | 35.2 | 33.2 | 43.9 | 52.2 | 74.7 | 78.1 | 93.4 | 81.1 |
| AUSTRALIA......... | 0.4 | 4.3 | 10.3 | 9.3 | 14.0 | 5.2 | 1.3 | 1.1 | 0.7 | 1.0 |
| BELGIUM........... | 266.8 | 252.8 | 252.5 | 245.0 | 267.4 | 289.0 | 311.0 | 307.9 | 307.4 | 315.5 |
| CANADA............ | 11.5 | 24.0 | 9.9 | 14.3 | 24.4 | 30.6 | 43.6 | 59.8 | 64.5 | 53.5 |
| DENMARK........... | 17.1 | 21.1 | 21.9 | 18.6 | 22.1 | 24.7 | 29.8 | 28.4 | 34.3 | 27.8 |
| FINLAND........... | 21.7 | 24.9 | 26.7 | 28.7 | 27.2 | 26.3 | 20.7 | 20.3 | 21.6 | 23.5 |
| FRANCE............ | 291.1 | 315.3 | 332.5 | 300.4 | 352.0 | 394.6 | 365.0 | 395.9 | 428.1 | 407.1 |
| GERMANY, FED REP... | 410.9 | 487.2 | 589.1 | 476.0 | 542.1 | 570.9 | 698.4 | 703.6 | 764.3 | 710.3 |
| GREECE............ | 0.4 | 0.4 | 0.2 | 2.8 | 4.0 | 2.1 | 6.5 | 3.6 | 7.2 | 13.5 |
| ICELAND........... | 1.3 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| IRELAND........... | 6.3 | 7.9 | 5.5 | 2.5 | 2.8 | 2.0 | 3.1 | 2.6 | 3.8 | 2.3 |
| ISRAEL............ | 18.3E | 16.6E | 18.4E | 14.6E | 14.6 | 14.0 | 14.5E | 14.0E | 15.0E | 15.0E |
| ITALY............. | 190.5 | 236.6 | 294.8 | 208.8 | 211.2 | 254.5 | 291.8 | 319.9 | 347.7 | 376.9 |
| JAPAN............. | 740.2 | 748.4 | 910.1 | 1129.3 | 1446.6 | 1603.7 | 1347.8 | 1575.5 | 1366.0 | 1835.3 |
| NETHERLANDS........ | 145.0 | 167.3 | 215.8 | 161.4 | 195.5 | 284.6 | 133.0 | 133.4 | 151.1 | 145.5 |
| NEW ZEALAND........ | 0.3 | 0.3 | 0.3 | 3.6 | 7.5 | 6.7 | 1.7 | 0.7 | 0.3 | 2.7 |
| NORWAY............ | 7.9 | 8.9 | 16.4 | 14.8 | 20.9 | 11.2 | 31.6 | 34.7 | 35.1 | 57.1 |
| PORTUGAL.......... | 20.2 | 20.0 | 27.4 | 42.5 | 49.5 | 43.0 | 26.1 | 33.9 | 39.0 | 43.5 |
| SOUTH AFRICA....... | 0.5 | 0.5 | 2.6 | 2.4 | 3.3 | 6.4 | 0.8 | 0.3 | 0.4 | 0.3E |
| SPAIN............. | 38.0 | 7.2 | 3.2 | 13.6 | 18.3 | 12.4 | 10.5 | 10.7 | 21.8 | 13.7 |
| SWEDEN............ | 34.2 | 36.7 | 36.9 | 38.7 | 45.5 | 49.7 | 48.5 | 46.3 | 54.3 | 43.1 |
| SWITZERLAND........ | 35.3 | 41.2 | 54.2 | 37.6 | 48.1 | 57.8 | 63.2 | 78.7 | 88.3 | 90.2 |
| UNITED KINGDOM..... | 191.6 | 185.5 | 171.4 | 123.3 | 154.8 | 163.6 | 172.1 | 147.1 | 182.2 | 175.8 |
| U.S.A............. | 686.2 | 517.5 | 526.8 | 644.5 | 616.4 | 742.5 | 881.0 | 868.7 | 1346.3 | 1245.7 |
| DEVELOPING COUNTRIES.......... | 555.0 | 538.3 | 636.3 | 563.5 | 642.3 | 732.8 | 689.8 | 789.9 | 790.4 | 916.5 |
| AFRICA............ | 12.9 | 10.8 | 16.4 | 16.2E | 15.2E | 10.7 | 13.5 | 16.3 | 12.5 | 13.5 |
| ALGERIA........... | 1.9 | 1.9 | 3.7 | 3.3 | 3.9 | 3.4 | 6.8 | 6.0 | 6.6 | 7.7 |
| CAMEROON.......... | 0.1 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| EGYPT............. | 0.2 | 1.0 | 0.6 | 0.5E | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 |
| GHANA............. | 2.1 | 0.2E | 0.2E | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.5 |
| KENYA............. | 0.1 | 0.3 | 0.6 | 0.3 | 0.9 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| LIBERIA........... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.0 | 0.0 | 0.4 |
| LIBYAN ASPJ....... | 0.0 | 0.1 | 0.2 | 0.7 | 0.4E | 0.2E | 0.2E | 0.3E | 0.5E | 0.4 |
| MADAGASCAR........ | 1.1 | 0.5E | 0.5E | 0.3E | 0.2E | 0.0E | 0.0 | 0.0 | 0.0 | 0.0 |
| MOROCCO........... | 0.4 | 0.3 | 1.1 | 1.1 | 1.2 | 1.5 | 1.1 | 1.0 | 1.6 | 1.1 |
| NIGERIA........... | 2.3 | 3.2E | 6.2E | 4.0E | 4.0E | 2.3 | 2.9 | 6.6 | 1.2 | 1.0E |
| TANZANIA.......... | 4.7 | 2.1 | 3.0 | 2.5E | 2.0E | 2.0 | 0.9 | 0.7 | 0.5 | 1.4 |
| TUNISIA........... | 0.0 | 0.4 | 0.2 | 1.6 | 1.0 | 0.2 | 0.9 | 1.6 | 2.0 | 0.9 |
| ZIMBABWE.......... | 0.0 | 0.0 | 0.1 | 1.9 | 1.6 | 0.4 | 0.1 | 0.1 | 0.1 | 0.1 |
| AMERICA........... | 183.7 | 136.4 | 145.5 | 102.1 | 83.3 | 54.5 | 66.5 | 56.8 | 87.8 | 77.5 |
| ANTIGUA........... | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 |

## Table A.11 : IMPORTS OF UNWROUGHT ALUMINIUM

(Thousand metric tons)

| | *1978* | *1979* | *1980* | *1981* | *1982* | *1983* | *1984* | *1985* | *1986* | *1987* |
|---|---|---|---|---|---|---|---|---|---|---|
| ARGENTINA.......... | 3.5 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 |
| BRAZIL............. | 60.3 | 51.8 | 46.7 | 28.2 | 10.8 | 2.9 | 4.6 | 2.6 | 1.4 | 2.3 |
| CHILE.............. | 4.3 | 4.0E | 4.4 | 3.1 | 3.0E | 2.0E | 1.5E | 1.5E | 1.5E | 2.1 |
| COLOMBIA........... | 17.3 | 16.4 | 13.4 | 15.7 | 14.3 | 18.0 | 18.0 | 11.7 | 21.4 | 17.9 |
| COSTA RICA......... | 0.0 | 0.0 | 0.7 | 2.1 | 0.0 | 0.0 | 2.5 | 0.1 | 0.2 | 0.1 |
| CUBA............... | 0.0 | 0.2 | 1.0 | 0.8 | 0.4 | 0.5E | 0.5E | 0.5E | 0.5E | 2.0 |
| DOMIN,REP.......... | 1.4 | 0.9 | 1.6 | 1.4 | 0.9 | 1.2 | 1.3 | 1.0 | 1.0 | 1.6 |
| ECUADOR............ | 1.8 | 1.4 | 3.6 | 1.9 | 2.9 | 3.3 | 4.4 | 1.0 | 1.5 | 3.3 |
| EL SALVAD.......... | 2.4 | 2.4 | 1.6 | 1.3 | 0.9 | 1.1 | 1.2 | 0.5 | 1.7 | 1.3 |
| GUATEMALA.......... | 0.4 | 0.6 | 0.6 | 0.4 | 0.3 | 0.4 | 0.5 | 0.5 | 0.5 | 0.6 |
| JAMAICA............ | 1.7 | 1.0 | 0.8 | 1.1 | 1.6 | 1.5 | 1.0 | 0.7 | 0.7 | 0.9 |
| MEXICO............. | 43.1 | 39.3 | 62.8 | 40.2 | 39.8 | 17.5 | 25.1 | 29.7 | 44.8 | 33.2 |
| NICARAGUA.......... | 0.5 | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PANAMA,EXZ......... | 0.9 | 1.3 | 1.2 | 1.6 | 1.3 | 1.3 | 1.2 | 1.4 | 1.6 | 1.8 |
| PERU............... | 2.8E | 5.0E | 5.4 | 1.4 | 3.8 | 3.3 | 3.4 | 4.0 | 5.3 | 5.9 |
| URUGUAY............ | 3.3 | 3.9 | 1.1 | 2.3 | 2.0E | 0.8 | 1.0 | 1.5 | 2.0 | 2.7 |
| VENEZUELA.......... | 39.9 | 8.0 | 0.1 | 0.5 | 1.3 | 0.3 | 0.2 | 0.1 | 3.7 | 1.8 |
| **ASIA**............... | **316.8** | **349.9** | **415.8** | **393.4** | **512.4** | **630.1** | **575.7** | **677.5E** | **658.1** | **792.9** |
| BAHRAIN............ | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 |
| BANGLADESH......... | 2.3E | 4.0E | 3.4E | 6.7E | 5.7E | 3.5 | 8.0 | 12.0 | 8.6 | 5.0 |
| BRUNEI............. | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| BURMA.............. | 0.5E | 0.2E | 0.3E | 0.3E | 0.3E | 0.5E | 0.4E | 0.4E | 0.4E | 0.5E |
| CYPRUS............. | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 4.7 |
| HONG KONG.......... | 28.5 | 30.5 | 40.5 | 38.0 | 72.2 | 55.8 | 35.6 | 76.1 | 46.9 | 70.5 |
| INDIA.............. | 14.0 | 25.0 | 86.5 | 30.2 | 6.7 | 17.9 | 54.8 | 41.7 | 64.2 | 41.7 |
| INDONESIA.......... | 12.2 | 15.2 | 14.1 | 21.1 | 33.7 | 20.1 | 17.2 | 11.9 | 9.6 | 12.1 |
| IRAN............... | 20.0E | 10.0E | 7.2 | 10.4 | 22.9 | 27.4 | 25.0 | 13.0 | 13.6 | 9.5 |
| IRAQ............... | 5.0E | 2.0E | 10.0E | 5.0E | 3.0E | 1.0E | 1.0E | 1.5E | 1.5E | 1.5E |
| JORDAN............. | 0.0 | 0.1 | 0.1 | 0.4 | 0.5 | 2.4 | 2.7 | 5.3 | 4.5 | 5.3 |
| KOREA REP.......... | 86.5 | 82.8 | 73.8 | 98.6 | 109.8 | 142.0 | 143.2 | 200.4 | 184.5 | 200.2 |
| KUWAIT............. | 0.0 | 0.0 | 0.4 | 1.3 | 0.5 | 0.7 | 0.4 | 1.0E | 1.0E | 1.0E |
| LEBANON............ | 13.0E | 15.0E | 4.5E | 2.0E | 1.0E | 1.3E | 2.1 | 2.0E | 2.0E | 2.0E |
| MALAYSIA........... | 3.5 | 14.5 | 16.4 | 14.9 | 23.1 | 41.9 | 31.7 | 21.2 | 26.4 | 19.8 |
| PAKISTAN........... | 4.5 | 3.8 | 2.1 | 2.7 | 5.8 | 2.0 | 1.8 | 7.4 | 7.7 | 8.0E |
| PHILIPP............ | 16.8 | 28.4 | 17.7 | 10.4 | 18.5 | 14.8 | 6.6 | 4.9 | 6.3 | 14.0E |
| SAUDI ARABIA....... | 1.6 | 1.4 | 7.4 | 7.9 | 6.3 | 7.3 | 14.0 | 10.1 | 18.0 | 15.0E |
| SINGAPORE.......... | 7.9 | 6.0 | 9.1 | 8.4 | 11.0 | 18.8 | 10.8 | 14.4 | 15.7 | 40.6 |
| SYRIAN............. | 1.5 | 1.3 | 1.5 | 1.7 | 1.8 | 1.4 | 2.5 | 3.0E | 3.0E | 3.0E |
| TAIWAN............. | 48.7 | 52.9 | 58.3 | 47.8 | 88.6 | 138.9 | 99.9 | 147.2 | 156.0 | 195.1 |
| THAILAND........... | 34.0 | 43.2 | 44.8 | 51.1 | 58.5 | 64.5 | 49.0 | 44.7 | 47.5 | 53.7 |
| TURKEY............. | 11.2 | 13.0 | 11.2 | 34.2 | 35.1 | 60.0 | 68.5 | 59.2E | 38.4 | 89.6 |
| U.A.EMIRAT......... | 0.0 | 0.0 | 6.4 | 0.1 | 7.2 | 7.7 | 0.3 | 0.0 | 0.2 | 0.0 |
| **EUROPE**............. | **41.6** | **41.2** | **58.6** | **51.8** | **31.4** | **37.5** | **34.1** | **39.3** | **32.0** | **32.6** |
| YUGOSLAVIA......... | 41.6 | 41.2 | 58.6 | 51.8 | 31.4 | 37.5 | 34.1 | 39.3 | 32.0 | 32.6 |
| | | | | | | | | | | |
| **SOCIALIST COUNTRIES OF EASTERN EUROPE**... | **502.3** | **526.3** | **577.6** | **519.6** | **530.3** | **566.3** | **570.0** | **577.4** | **607.4** | **584.1** |
| BULGARIA........... | 33.0E | 35.0E | 37.0E | 40.0E | 45.0E | 45.0E | 50.0E | 55.0E | 57.0E | 56.0E |
| CZECHOSLOVAKIA..... | 95.0 | 88.0 | 93.0 | 82.0 | 66.0 | 88.0 | 90.0 | 80.0 | 78.0 | 76.0 |
| GERMAN DR.......... | 165.0E | 170.0E | 170.0E | 170.0E | 180.0E | 173.0E | 160.0E | 170.0E | 165.0E | 160.0E |

Table A.11 : IMPORTS OF UNWROUGHT ALUMINIUM

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| HUNGARY............ | 147.6 | 158.6 | 187.9 | 154.5 | 137.1 | 163.0 | 163.3 | 165.3 | 205.0 | 190.0 |
| POLAND............ | 60.0E | 73.0E | 88.7 | 72.1 | 101.2 | 95.3 | 104.7 | 102.9 | 99.9 | 99.1 |
| ROMANIA........... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.9 | 2.6 | 1.0 | 1.0 |
| USSR.............. | 1.7 | 1.7 | 1.0 | 1.0 | 1.0 | 0.0 | 1.1 | 1.6 | 1.5 | 2.0 |
| **SOCIALIST COUNTRIES OF ASIA............** | **167.6** | **147.2E** | **116.4E** | **64.3E** | **174.2E** | **287.5E** | **257.5E** | **499.9E** | **281.2E** | **159.6E** |
| CHINA............. | 165.7 | 146.1 | 110.2 | 57.8 | 169.6 | 283.8 | 252.7 | 487.9 | 266.2 | 148.1 |
| KOREA DPR.......... | 0.9 | 0.1 | 5.2 | 5.5 | 3.6 | 2.7 | 3.8 | 11.0 | 14.0E | 10.0E |
| VIETNAM........... | 1.0 | 1.0E | 1.0E | 1.0E | 1.0E | 1.0E | 1.0E | 1.0E | 1.0E | 1.5E |

Table A.12 : EXPORTS OF SEMI-MANUFACTURED ALUMINIUM PRODUCTS

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD.............. | 2018.3 | 2302.0 | 2380.3 | 2307.8 | 2441.3 | 2832.5 | 3116.0 | 3223.8 | 3261.1 | 3605.9 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 1738.6 | 1970.6 | 2009.9 | 1961.8 | 2041.5 | 2316.5 | 2501.3 | 2513.5 | 2554.8 | 2841.6 |
| AUSTRIA........... | 65.4 | 72.4 | 63.6 | 64.6 | 68.7 | 89.2 | 92.4 | 98.1 | 102.6 | 114.0 |
| AUSTRALIA.......... | 5.1 | 16.6 | 19.9 | 26.5 | 37.0 | 50.3 | 54.7 | 61.3 | 58.7 | 65.2 |
| BELGIUM........... | 227.3 | 242.5 | 219.8 | 222.8 | 243.1 | 267.8 | 280.0 | 283.1 | 287.6 | 323.7 |
| CANADA............ | 19.2E | 14.2E | 15.0E | 23.3E | 27.8E | 44.8E | 71.2E | 48.8E | 44.8E | 62.9E |
| DENMARK........... | 12.5 | 15.4 | 18.1 | 16.5 | 19.3 | 24.8 | 28.7 | 27.9 | 29.2 | 28.9 |
| FINLAND........... | 19.8 | 23.3 | 28.8 | 22.8 | 19.1 | 20.7 | 22.9 | 19.2 | 9.3 | 11.2 |
| FRANCE............ | 217.5 | 260.9 | 233.2 | 248.4 | 265.3 | 294.8 | 287.9 | 283.0 | 286.3 | 335.1 |
| GERMANY, FED REP... | 344.0 | 385.4 | 372.2 | 390.2 | 434.2 | 494.1 | 538.2 | 541.8 | 545.7 | 563.9 |
| GREECE............ | 26.6 | 30.4 | 32.8 | 26.7 | 29.1 | 40.6 | 48.3 | 49.5 | 39.1 | 46.5 |
| IRELAND........... | 1.4 | 2.1 | 2.5 | 2.1 | 1.8 | 1.7 | 1.0 | 2.0 | 1.7 | 1.6 |
| ISRAEL............ | 14.4 | 15.7E | 21.9E | 15.2E | 14.8E | 19.5E | 15.2E | 18.7E | 20.5E | 21.0E |
| ITALY............. | 108.8 | 112.7 | 88.4 | 97.5 | 105.9 | 117.5 | 120.0 | 134.6 | 138.5 | 142.5 |
| JAPAN............. | 132.4E | 97.8E | 89.2E | 126.7E | 155.5 | 198.0 | 228.8 | 246.1 | 225.5 | 213.8 |
| NETHERLANDS........ | 80.4 | 96.1 | 106.0 | 93.6 | 89.7 | 106.8 | 107.3 | 109.4 | 121.2 | 134.1 |
| NEW ZEALAND........ | 2.1 | 3.4 | 6.1 | 6.8 | 9.2 | 7.0 | 9.8 | 9.0 | 7.0 | 7.7 |
| NORWAY............ | 56.7 | 65.2 | 66.0 | 68.6 | 69.4 | 93.5 | 82.4 | 82.4 | 85.8 | 100.4 |
| PORTUGAL.......... | 0.0 | 4.9 | 3.8 | 2.7 | 3.6 | 5.7 | 1.5 | 3.8 | 5.0 | 5.2 |
| SOUTH AFRICA....... | 2.1E | 3.8E | 4.0E | 1.2E | 0.7E | 1.6E | 1.7E | 1.5E | 1.2E | 1.0E |
| SPAIN............. | 10.8 | 21.6 | 19.5 | 18.8 | 18.2 | 14.1 | 27.3 | 32.1 | 32.1 | 40.9 |
| SWEDEN............ | 57.5 | 63.1 | 50.9 | 45.5 | 49.9 | 55.8 | 46.3 | 48.7 | 56.0 | 52.3 |
| SWITZERLAND........ | 66.0 | 76.4 | 75.3 | 68.4 | 75.4 | 84.5 | 92.2 | 101.7 | 104.9 | 106.8 |
| UNITED KINGDOM..... | 63.1 | 73.9 | 125.0E | 81.4 | 98.7 | 95.0 | 113.0 | 115.8 | 134.5 | 141.6 |
| U.S.A............. | 205.4 | 272.7 | 347.8 | 291.0 | 205.1 | 188.7 | 230.4 | 194.9 | 216.9 | 320.6 |
| DEVELOPING COUNTRIES........... | 131.1 | 175.8 | 196.2 | 180.8 | 214.3 | 328.6 | 424.5 | 508.2 | 490.8 | 541.6 |
| AFRICA............ | 16.9E | 44.2E | 21.2 | 23.9 | 43.5E | 73.9E | 103.5E | 133.2 | 109.6 | 114.6 |
| CAMEROON.......... | 6.0 | 10.0 | 5.9 | 8.6E | 8.7 | 8.5E | 8.6E | 7.1E | 5.7 | 5.3 |
| COTE D'IVOIRE...... | 1.2 | 1.6 | 1.5E | 1.4 | 0.9 | 0.6 | 0.5E | 0.5 | 0.0 | 0.5 |
| EGYPT............. | 9.3 | 31.7 | 12.4 | 12.8 | 33.2 | 64.1 | 93.5 | 123.8 | 101.6 | 107.4 |
| KENYA............. | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1E | 0.1 | 0.1 | 0.1 |
| SENEGAL........... | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TANZANIA.......... | 0.2E | 0.7E | 0.9 | 0.6 | 0.6E | 0.6E | 0.6E | 0.6 | 0.6 | 0.6 |
| TUNISIA........... | 0.0 | 0.0 | 0.3 | 0.4 | 0.0 | 0.0 | 0.2 | 1.1 | 1.6 | 0.7 |
| AMERICA........... | 12.1 | 38.1 | 58.5 | 49.4 | 19.1 | 70.6 | 133.9 | 147.9 | 149.4 | 151.0E |
| ARGENTINA......... | 1.6 | 4.5 | 7.9 | 10.9 | 5.7 | 6.3 | 6.9 | 8.4 | 13.5 | 17.8 |
| BRAZIL............ | 1.3 | 4.2 | 8.0 | 9.7 | 8.5 | 38.3 | 55.4E | 30.1 | 32.4 | 27.0 |
| CHILE............. | 0.1E | 0.1E | 0.1 | 0.1 | 0.1E | 0.1E | 0.1E | 0.1E | 0.1E | 0.2E |
| COLOMBIA.......... | 0.4 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.5E |
| COSTA RICA......... | 0.3 | 0.1 | 0.2 | 0.2 | 0.8 | 1.1E | 3.2 | 2.0E | 1.0E | 0.4E |
| ECUADOR........... | 0.0 | 0.1 | 0.2 | 0.4 | 0.3 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 |
| EL SALVADOR......... | 2.8 | 2.9 | 2.9 | 1.9 | 1.3 | 1.2E | 1.9 | 1.0 | 0.7 | 0.3E |
| GUATEMALA......... | 0.4 | 0.7 | 0.4 | 0.6 | 0.5 | 0.6 | 0.2 | 0.2 | 0.2 | 0.2E |

Table A.12 : EXPORTS OF SEMI-MANUFACTURED ALUMINIUM PRODUCTS

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| JAMAICA............ | 0.7 | 0.6E | 0.7 | 0.6E | 0.6E | 0.6E | 0.6E | 0.8E | 1.0E | 1.0E |
| MEXICO............. | 1.6 | 1.1 | 0.6E | 0.2 | 0.3 | 0.8 | 3.4 | 2.5 | 3.0 | 3.0 |
| NICARAGUA.......... | 0.8 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PERU............... | 0.2 | 0.2 | 0.1 | 0.2 | 0.1 | 0.2E | 0.2E | 0.3E | 0.3E | 0.3E |
| URUGUAY............ | 0.3 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.3 |
| VENEZUELA.......... | 1.6 | 23.1 | 37.2 | 24.4 | 0.8 | 21.1 | 61.8 | 102.4 | 96.9 | 100.0E |
| ASIA............... | 47.0 | 43.2 | 59.1 | 59.3 | 101.6 | 114.7 | 125.2 | 160.4 | 147.5 | 171.4 |
| BAHRAIN............ | 0.4 | 0.8 | 3.7 | 2.1 | 26.5 | 28.0 | 32.0 | 37.0 | 40.0 | 45.0 |
| CYPRUS............. | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.3 |
| HONG KONG.......... | 7.9 | 9.1 | 8.9 | 8.6 | 10.7 | 8.7 | 8.7 | 12.1 | 14.3 | 16.4 |
| INDIA.............. | 8.2 | 4.3 | 5.0 | 3.5 | 10.3 | 6.5 | 5.6 | 13.5 | 13.0 | 13.5 |
| INDONESIA.......... | 0.1 | 0.8E | 0.5 | 0.3E | 0.2 | 1.9 | 2.2 | 0.5 | 1.4E | 2.0 |
| KOREA REP.......... | 6.0 | 3.7 | 11.9 | 16.1E | 13.3 | 10.1 | 11.0 | 24.2 | 18.1 | 24.8 |
| KUWAIT............. | 0.5 | 1.1 | 1.7 | 0.5 | 0.6 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| LEBANON............ | 2.0 | 1.0E | 0.5E | 0.5E | 0.5E | 0.5E | 0.5E | 0.0E | 0.0E | 0.0E |
| MALAYSIA........... | 1.6 | 2.5 | 4.5 | 4.7 | 7.0 | 8.6 | 10.8E | 7.3 | 8.8 | 10.0 |
| PAKISTAN........... | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PHILIPP............ | 1.9 | 0.9 | 2.9 | 2.9 | 4.6 | 2.9 | 0.2E | 0.1E | 0.0 | 0.0 |
| SAUDI ARABIA....... | 0.2 | 0.4 | 0.4 | 0.3 | 0.2 | 0.2E | 0.2 | 0.2 | 0.2 | 0.2 |
| SINGAPORE.......... | 3.6 | 3.9 | 4.3 | 4.4 | 6.8 | 14.4 | 7.2 | 8.0 | 9.2 | 8.6 |
| SRI LANKA.......... | 0.0 | 0.0 | 0.1E | 0.0 | 0.1E | 0.1E | 0.1E | 0.0 | 0.0 | 0.0 |
| TAIWAN............. | 7.4 | 7.6 | 7.4 | 6.5 | 6.8 | 12.0E | 20.0E | 30.6 | 18.2 | 23.4 |
| THAILAND........... | 1.4 | 1.4 | 1.6 | 0.8 | 1.0 | 0.9 | 1.1 | 1.0 | 1.7 | 1.4 |
| TURKEY............. | 5.6 | 5.5 | 5.6 | 7.9 | 12.9 | 19.4 | 25.1 | 25.4 | 22.2 | 25.4 |
| EUROPE............. | 55.1 | 50.3 | 57.4 | 48.2 | 50.1 | 69.4 | 61.9 | 66.7 | 84.3 | 104.6 |
| YUGOSLAVIA......... | 55.1 | 50.3 | 57.4 | 48.2 | 50.1 | 69.4 | 61.9 | 66.7 | 84.3 | 104.6 |
| SOCIALIST COUNTRIES OF EASTERN EUROPE... | 147.3E | 153.6E | 168.5E | 164.3E | 180.6E | 182.4E | 184.2E | 196.4E | 209.5E | 216.6E |
| BULGARIA........... | 7.0E | 13.0E | 14.0E | 13.0E | 12.0E | 10.0E | 10.0E | 10.0E | 10.0E | 10.0E |
| CZECHOSLOVAKIA..... | 5.7E | 5.5E | 5.3E | 7.0E | 8.0E | 8.0E | 8.0E | 9.0E | 9.0E | 9.0E |
| GERMAN DR.......... | 13.0E | 12.7E | 14.6E | 15.8E | 16.7E | 17.0E | 17.0E | 17.0E | 19.0E | 20.0E |
| HUNGARY............ | 31.4 | 27.2 | 28.9 | 31.2 | 42.3 | 48.5 | 45.8 | 51.7 | 58.8 | 58.0 |
| POLAND............. | 0.2E | 0.2E | 1.2 | 0.3 | 1.6 | 2.9 | 3.4 | 3.7 | 2.7 | 2.6 |
| ROMANIA............ | 40.0 | 25.0 | 34.5 | 27.0 | 30.0 | 31.0 | 35.0E | 40.0E | 45.0E | 49.0 |
| USSR............... | 50.0E | 70.0E | 70.0E | 70.0E | 70.0E | 65.0E | 65.0E | 65.0E | 65.0E | 68.0E |
| SOCIALIST COUNTRIES OF ASIA............ | 1.3E | 2.0E | 5.7E | 0.9E | 4.9 | 5.0 | 6.0 | 5.7 | 6.0 | 6.1 |
| CHINA.............. | 1.3E | 2.0E | 5.7E | 0.9E | 4.9 | 5.0 | 6.0 | 5.7 | 6.0 | 6.1 |

Table A.13 : IMPORTS OF SEMI-MANUFACTURED ALUMINIUM PRODUCTS

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD.............. | 1906.3 | 2174.6 | 2213.5 | 2186.9 | 2300.4 | 2561.8 | 2895.4 | 2978.9 | 3100.6 | 3396.0 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 1404.9 | 1631.7 | 1595.0 | 1539.2 | 1688.9 | 1939.5 | 2271.1 | 2254.5 | 2454.7 | 2663.3 |
| AUSTRIA............ | 29.2 | 36.3 | 38.9 | 37.4 | 42.0 | 48.3 | 51.9 | 54.6 | 54.6 | 63.5 |
| AUSTRALIA.......... | 6.0E | 8.7 | 11.6 | 15.5 | 15.3E | 11.1E | 14.5E | 17.1E | 16.0E | 18.9E |
| BELGIUM............ | 75.7 | 84.3 | 86.1 | 83.9 | 86.9 | 90.2 | 94.0 | 96.0 | 110.1 | 119.1 |
| CANADA............. | 85.2E | 117.3E | 105.0E | 113.5E | 93.4E | 117.8E | 177.1E | 155.2E | 142.9E | 169.9E |
| DENMARK............ | 58.0 | 62.8 | 59.0 | 53.5 | 56.6 | 62.7 | 68.9 | 66.5 | 72.8 | 78.9 |
| FINLAND............ | 24.4 | 32.2 | 35.0 | 26.9 | 28.2 | 30.2 | 30.7 | 29.7 | 34.6 | 38.7 |
| FRANCE............. | 153.4 | 198.0 | 220.0 | 200.3 | 215.7 | 217.1 | 216.6 | 224.9 | 267.1 | 281.6 |
| GERMANY, FED REP... | 204.9 | 258.2 | 280.5 | 236.0 | 253.2 | 285.6 | 291.5 | 314.8 | 345.1 | 396.9 |
| GREECE............. | 3.1 | 3.6 | 4.0 | 4.4 | 4.0 | 5.1 | 5.3 | 4.6 | 7.6 | 10.5 |
| ICELAND............ | 0.8 | 1.0 | 1.2 | 1.2 | 1.2 | 1.0 | 1.1 | 0.9 | 1.2 | 1.4 |
| IRELAND............ | 14.1 | 15.0 | 19.0 | 19.0 | 21.2 | 27.4 | 32.2 | 31.7 | 36.2 | 39.5 |
| ISRAEL............. | 16.6E | 15.9E | 15.0E | 20.7E | 19.1E | 20.4E | 21.9E | 26.0E | 21.7E | 23.0 |
| ITALY.............. | 62.3 | 92.1 | 112.6 | 83.0 | 85.5 | 112.4 | 118.2 | 123.3 | 139.1 | 170.1 |
| JAPAN.............. | 25.9 | 33.1 | 46.2 | 31.1 | 30.2 | 36.8 | 41.6 | 34.8 | 35.6 | 55.3 |
| NETHERLANDS........ | 93.7 | 107.4 | 117.0 | 95.7 | 107.9 | 117.0 | 120.5 | 126.0 | 134.5 | 149.6 |
| NEW ZEALAND........ | 3.3 | 3.9 | 3.5 | 3.2 | 3.9 | 3.7 | 4.5 | 4.9 | 6.5 | 10.8 |
| NORWAY............. | 39.7 | 36.2 | 45.6 | 43.5 | 40.3 | 41.9 | 46.6 | 47.5 | 54.4 | 36.5 |
| PORTUGAL........... | 15.9 | 13.8 | 15.5 | 14.3 | 13.3 | 14.3 | 12.0 | 12.8 | 14.1 | 16.6 |
| SOUTH AFRICA....... | 7.4 | 7.2 | 12.7 | 15.6 | 12.6 | 12.6 | 15.1 | 13.7 | 15.0E | 16.0E |
| SPAIN.............. | 12.1 | 14.6 | 16.8 | 14.1 | 18.5 | 26.8 | 18.7 | 22.8 | 42.3 | 50.4 |
| SWEDEN............. | 51.1 | 59.4 | 62.0 | 60.8 | 70.0 | 80.7 | 83.4 | 77.3 | 86.3 | 89.5 |
| SWITZERLAND........ | 35.5 | 42.5 | 50.8 | 47.5 | 47.7 | 53.3 | 56.4 | 62.1 | 65.8 | 65.7 |
| UNITED KINGDOM..... | 163.8 | 188.8 | 155.5 | 169.5 | 209.2 | 237.5 | 248.0 | 239.6 | 251.8 | 298.7 |
| U.S.A.............. | 221.7 | 198.2 | 78.9 | 146.9 | 211.6 | 283.7 | 498.3 | 465.4 | 496.4 | 458.3 |
| DEVELOPING COUNTRIES........... | 399.4 | 434.0 | 497.4 | 533.5 | 506.6 | 522.6 | 522.8 | 589.8 | 529.3 | 610.0 |
| AFRICA............. | 67.2 | 71.0 | 84.6 | 84.4 | 88.5 | 91.8 | 78.4 | 71.2 | 66.8 | 62.7 |
| ALGERIA............ | 9.6 | 8.2 | 8.0 | 11.2 | 9.0 | 14.1 | 13.5 | 18.6 | 16.8 | 13.8 |
| BURKINA FASO....... | 0.4 | 0.5 | 0.4 | 0.5 | 0.5 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 |
| CAMEROON........... | 1.2E | 1.2 | 1.3 | 1.9E | 1.0 | 0.9 | 0.7 | 0.1 | 1.2 | 1.1 |
| CONGO.............. | 0.1 | 0.3 | 0.4 | 0.9 | 1.0 | 3.8 | 2.2 | 1.6 | 1.8 | 2.0 |
| COTE D'IVOIRE...... | 8.3 | 7.5 | 6.6 | 5.6 | 4.4 | 5.6 | 3.3 | 2.9 | 3.0 | 3.0 |
| EGYPT.............. | 2.8 | 1.1 | 2.8 | 3.4 | 2.3 | 4.8 | 10.0 | 3.6 | 3.1 | 2.7 |
| ETHIOPIA........... | 0.3 | 0.4 | 0.3 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 |
| GABON.............. | 0.4 | 0.3 | 0.2 | 0.7 | 0.7 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| GHANA.............. | 1.4 | 1.5 | 1.3 | 1.1 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 |
| KENYA.............. | 3.8 | 1.8 | 3.2 | 1.6 | 1.9 | 1.8 | 2.0 | 2.0 | 2.0 | 2.0 |
| LIBERIA............ | 0.5 | 1.0 | 0.5 | 0.4 | 0.3 | 0.6 | 0.4 | 0.5 | 0.5 | 0.5 |
| LIBYAN ASPJ........ | 4.4 | 5.6 | 11.0 | 5.3 | 11.3 | 13.0E | 10.0E | 7.0E | 6.0E | 7.0E |
| MADAGASCAR......... | 0.5 | 1.1 | 0.8 | 0.3 | 0.2 | 0.3 | 0.2 | 0.3 | 0.2 | 0.2 |
| MALAWI............. | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MALI............... | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

Table A.13 : IMPORTS OF SEMI-MANUFACTURED ALUMINIUM PRODUCTS

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| MAURITIUS.......... | 0.5 | 0.6 | 0.8 | 0.3 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| MOROCCO............ | 4.1 | 6.6 | 4.5 | 4.5 | 5.7 | 5.9 | 6.2 | 4.5 | 4.8 | 5.0 |
| NIGER.............. | 0.6 | 1.0 | 0.9 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| NIGERIA............ | 19.2 | 23.3E | 30.5E | 34.0E | 37.0E | 29.0E | 17.0E | 18.0E | 14.0E | 11.0E |
| REUNION............ | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.4 |
| SENEGAL............ | 0.4 | 0.3 | 0.3 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| SIERRA LEONE....... | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| SUDAN.............. | 1.2 | 1.3 | 1.5 | 1.4 | 2.0 | 1.5 | 1.1 | 1.1 | 2.0 | 2.0 |
| TANZANIA........... | 1.4 | 1.6 | 2.4 | 1.7 | 1.8 | 1.2 | 1.3 | 1.3 | 1.8 | 1.7 |
| TOGO............... | 0.3 | 0.2 | 0.3 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| TUNISIA............ | 2.7 | 2.5 | 3.6 | 5.0 | 4.0 | 2.9 | 3.9 | 3.2 | 2.6 | 3.6 |
| ZAIRE.............. | 1.1 | 1.1 | 1.0 | 0.7 | 0.8 | 1.2 | 1.2 | 1.2 | 1.8 | 1.5 |
| ZAMBIA............. | 0.9 | 0.8 | 0.8 | 0.7 | 0.3 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 |
| **AMERICA............** | **98.3** | **100.6** | **120.3** | **142.1** | **111.0** | **65.4** | **87.5** | **96.6** | **105.0** | **130.1** |
| ARGENTINA.......... | 0.3 | 0.8 | 1.7 | 2.2 | 1.0 | 0.8 | 0.8 | 0.8 | 1.1 | 8.8 |
| BAHAMAS............ | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| BARBADOS........... | 0.9 | 0.8E | 1.9 | 0.9E | 0.8E | 2.0E | 2.6E | 1.1E | 1.1E | 1.5E |
| BELIZE............. | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| BERMUDA............ | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| BOLIVIA............ | 1.2 | 1.1 | 0.9 | 1.0 | 0.4 | 0.9 | 0.3 | 0.3 | 0.3 | 0.3 |
| BRAZIL............. | 11.5 | 17.9 | 18.6 | 7.6 | 2.8 | 1.3 | 2.5 | 2.1 | 1.4 | 4.7 |
| CHILE.............. | 2.2 | 4.4E | 5.8 | 6.2 | 3.6 | 3.5 | 3.7 | 2.5 | 2.8 | 3.0 |
| COLOMBIA........... | 2.7 | 4.1 | 4.9 | 7.9 | 6.6 | 8.4 | 6.6 | 5.5 | 9.9 | 11.0 |
| COSTA RICA......... | 4.1 | 3.9 | 3.8 | 4.8 | 1.8 | 2.0 | 2.1 | 2.4 | 2.5 | 2.5 |
| CUBA............... | 2.2E | 2.0E | 1.6E | 4.9E | 2.0E | 1.5E | 1.0E | 1.0E | 1.0E | 1.0E |
| DOMIN,REP.......... | 1.7 | 2.1 | 2.6 | 1.2 | 1.2 | 1.6 | 1.8 | 2.5 | 2.5 | 2.5 |
| ECUADOR............ | 5.1 | 3.0 | 2.8 | 4.2 | 3.2 | 2.9 | 3.3 | 3.0 | 3.0 | 3.0 |
| EL SALVAD.......... | 4.1 | 3.6 | 1.8 | 2.1 | 2.0 | 2.0 | 2.2 | 2.5 | 2.5 | 2.5 |
| FRENCH GUIANA...... | 0.2 | 0.3 | 0.3 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| GUADALOUPE......... | 0.5 | 0.5 | 0.7 | 0.7 | 0.5 | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 |
| GUATEMALA.......... | 2.6 | 2.6 | 1.4 | 1.9 | 1.6 | 2.5 | 1.8 | 2.0 | 2.0 | 2.0 |
| GUYANA............. | 0.4 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| HAITI.............. | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| HONDURAS........... | 1.0 | 1.3 | 1.3 | 1.0 | 0.5 | 0.7 | 0.8 | 1.0 | 1.3 | 1.3 |
| JAMAICA............ | 2.8 | 2.1 | 1.3 | 2.2E | 2.4E | 2.5 | 2.5 | 3.0 | 3.0 | 3.0 |
| MARTINIQUE......... | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.4 | 0.3 | 0.2 | 0.5 | 0.2 |
| MEXICO............. | 25.0 | 25.8 | 33.1 | 59.3 | 46.8 | 8.4 | 20.2 | 34.2 | 35.0E | 39.0E |
| NICARAGUA.......... | 0.8 | 0.3 | 0.5 | 0.6 | 0.5 | 0.9E | 1.2 | 1.2 | 1.2 | 1.2 |
| PARAGUAY........... | 0.2 | 0.4 | 0.3 | 0.5 | 0.6 | 0.5 | 0.3 | 0.4 | 0.3 | 0.4 |
| PERU............... | 1.6 | 1.5 | 1.4 | 1.2 | 1.9 | 1.3 | 1.7 | 1.7E | 1.9 | 2.0 |
| TR.TOBAGO.......... | 1.3 | 2.3 | 4.1 | 3.6 | 5.5 | 5.0 | 5.6 | 5.6 | 2.5 | 2.7 |
| URUGUAY............ | 0.5 | 0.8 | 2.0E | 1.8E | 0.4E | 0.2E | 0.1E | 0.8 | 0.4 | 1.0 |
| VENEZUELA.......... | 24.6 | 17.6 | 26.2 | 24.7 | 23.4 | 14.5 | 24.4 | 21.1 | 27.1 | 34.9 |
| **ASIA...............** | **223.5** | **252.9** | **282.5** | **289.2** | **293.2** | **352.1** | **340.7** | **406.4** | **343.7** | **404.8** |
| AFGHANISTAN........ | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| BAHRAIN............ | 0.7 | 1.0 | 1.0E | 0.9 | 0.6E | 0.5E | 0.4E | 0.4E | 0.4E | 0.4E |
| BANGLADESH......... | 3.0E | 2.8E | 3.0E | 3.5E | 1.8E | 2.0E | 6.0E | 6.3E | 3.1E | 2.7E |
| CYPRUS............. | 3.0 | 3.6 | 3.6 | 2.7 | 3.8 | 4.2 | 4.1 | 4.1 | 2.5 | 1.3 |
| FIJI............... | 0.3 | 0.4 | 0.4 | 0.5 | 0.3 | 0.4 | 0.6 | 0.5 | 0.5 | 0.6 |
| HONG KONG.......... | 11.2 | 14.6 | 20.2 | 23.3 | 22.8 | 32.0 | 33.7 | 74.4 | 58.9 | 71.0 |
| INDIA.............. | 10.4 | 18.3 | 22.1 | 20.4 | 9.8 | 7.5 | 6.3 | 27.1 | 30.0E | 40.0E |
| INDONESIA.......... | 18.4 | 15.9 | 22.2 | 25.2 | 27.6 | 26.8 | 20.7 | 28.9 | 23.8 | 18.0 |

Table A.13 : IMPORTS OF SEMI-MANUFACTURED ALUMINIUM PRODUCTS

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| IRAN............... | 33.7E | 12.0E | 13.6E | 12.5E | 11.2E | 37.1E | 22.6E | 14.9E | 10.9E | 8.5E |
| IRAQ............... | 7.0E | 9.5E | 7.0E | 7.4E | 13.1E | 4.5E | 8.1E | 23.9E | 11.1E | 10.0E |
| JORDAN............ | 4.5 | 4.6 | 4.6 | 7.3 | 6.3 | 6.8 | 5.1 | 7.5 | 3.2 | 2.3 |
| KOREA REP.......... | 17.0 | 20.0 | 19.6 | 12.5 | 23.0 | 24.8 | 29.3 | 35.3 | 30.6 | 44.5 |
| KUWAIT............ | 6.8 | 11.7 | 16.5 | 15.5 | 14.0 | 18.0 | 14.7 | 13.5 | 9.6 | 11.0 |
| LEBANON........... | 2.5E | 3.3E | 5.0E | 3.5E | 2.5 | 3.0E | 2.6E | 2.9 | 2.8 | 1.7 |
| MALAYSIA.......... | 14.4 | 23.0 | 21.0 | 16.8 | 13.8 | 16.8 | 16.7 | 13.6 | 9.3 | 10.0 |
| PAKISTAN.......... | 3.3 | 4.8 | 8.8 | 8.4 | 13.6 | 13.1 | 12.9 | 7.4 | 7.5 | 7.2 |
| PHILIPP........... | 4.3 | 6.9 | 5.4 | 4.4 | 13.6 | 8.9 | 7.4 | 6.4 | 6.4 | 7.9 |
| QATAR............. | 0.9 | 0.6 | 0.8 | 2.4 | 1.9 | 1.7 | 1.3E | 1.1 | 1.2 | 1.0 |
| SAUDI ARABIA....... | 23.6 | 30.0 | 41.3 | 40.4 | 44.4 | 58.0E | 54.8 | 43.2 | 31.7 | 40.5 |
| SINGAPORE......... | 16.4 | 22.7 | 20.5 | 27.2 | 27.8 | 34.8 | 33.3 | 32.5 | 29.3 | 40.5 |
| SRI LANKA......... | 3.7 | 6.7 | 7.8 | 15.5 | 6.1 | 2.4 | 2.7 | 3.5 | 5.3 | 5.1 |
| SYRIAN............ | 10.5 | 10.3 | 11.1E | 14.3 | 6.4 | 11.8 | 12.6 | 9.0 | 10.0 | 9.0 |
| TAIWAN............ | 7.4 | 11.4 | 11.0 | 9.7 | 15.0 | 20.0E | 27.0E | 32.3E | 40.0E | 48.6 |
| THAILAND.......... | 4.9 | 5.0 | 3.3 | 3.7 | 3.8 | 5.1 | 6.4 | 4.7 | 3.6 | 6.5 |
| TURKEY............ | 1.5 | 0.9 | 0.9 | 0.9 | 1.1 | 0.9 | 1.4 | 3.0 | 3.9 | 8.5 |
| U.A.EMIRAT......... | 14.0E | 12.8 | 11.7 | 10.3 | 8.8 | 11.0 | 10.0 | 10.0 | 8.0 | 8.0 |
| FRENCH POLYNESIA... | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 |
| NEW CALEDONIA...... | 0.1 | 0.2 | 0.4 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| PAPUA NEW GUINEA... | 0.5 | 0.5 | 0.6 | 0.7 | 0.8 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 |
| **EUROPE............** | **9.5** | **8.5** | **8.6** | **16.4** | **12.5** | **12.0** | **14.8** | **14.1** | **12.3** | **10.9** |
| YUGOSLAVIA......... | 9.5 | 8.5 | 8.6 | 16.4 | 12.5 | 12.0 | 14.8 | 14.1 | 12.3 | 10.9 |
| **SOCIALIST COUNTRIES OF EASTERN EUROPE...** | **95.0** | **103.4** | **107.2** | **97.3** | **89.7** | **82.5** | **84.4** | **92.1** | **85.5** | **87.3** |
| ALBANIA........... | 0.2 | 0.4 | 0.6 | 1.8 | 1.5 | 1.0 | 1.0 | 0.6 | 0.6 | 0.7 |
| BULGARIA.......... | 5.7 | 11.2 | 9.1 | 8.2 | 5.7 | 5.7 | 6.1 | 6.8 | 5.0 | 6.0 |
| CZECHOSLOVAKIA..... | 20.7 | 20.0 | 18.3 | 16.0 | 16.5 | 16.2 | 16.4 | 21.1 | 20.0 | 23.0 |
| GERMAN DR.......... | 15.0 | 21.0 | 30.0 | 29.3 | 25.1 | 26.4 | 26.1 | 25.5 | 26.0 | 25.0 |
| HUNGARY........... | 10.2 | 11.8 | 9.3 | 15.8 | 15.0 | 15.0 | 14.5 | 13.0 | 13.5 | 13.5 |
| POLAND............ | 23.3 | 22.1 | 19.8 | 8.2 | 6.8 | 7.4 | 7.7 | 7.2 | 12.1 | 8.6 |
| ROMANIA........... | 6.2 | 5.9 | 5.1 | 3.0 | 2.1 | 0.7 | 2.3 | 1.7 | 2.0 | 2.0 |
| USSR.............. | 10.7 | 11.0 | 15.0 | 15.0 | 17.0 | 10.1 | 10.3 | 16.2 | 6.3 | 8.5 |
| **SOCIALIST COUNTRIES OF ASIA............** | **7.0** | **5.5** | **13.9** | **16.9** | **15.2** | **17.2** | **17.1** | **42.5** | **31.1** | **35.4** |
| CHINA............. | 5.5 | 4.4 | 12.7 | 14.7 | 13.8 | 14.5 | 15.0 | 40.9 | 30.4 | 34.2 |
| KOREA DPR......... | 0.9 | 0.9 | 1.0 | 2.0 | 1.2 | 1.8 | 1.1 | 1.3 | 0.5 | 1.0 |
| VIETNAM........... | 0.6 | 0.2 | 0.2 | 0.2 | 0.2 | 0.9 | 1.0 | 0.3 | 0.2 | 0.2 |

Table A.14 : EXPORTS OF ALUMINIUM WASTE AND SCRAP

(Thousand metric tons)

| | *1978* | *1979* | *1980* | *1981* | *1982* | *1983* | *1984* | *1985* | *1986* | *1987* |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 657.4 | 771.7 | 927.7 | 807.4 | 810.2 | 1011.4 | 1049.3 | 1194.8 | 1295.1 | 1476.8 |
| **DEVELOPED MARKET ECONOMY COUNTRIES...** | **514.1** | **672.4** | **844.1** | **690.9** | **693.3** | **877.0** | **887.6** | **1025.1** | **1095.5** | **1216.1** |
| AUSTRIA........... | 42.6 | 38.9 | 32.7 | 56.4 | 51.4 | 59.5 | 29.8 | 33.2 | 43.4 | 63.6 |
| AUSTRALIA.......... | 4.3E | 10.8 | 14.6 | 14.1 | 27.3 | 25.8 | 13.2 | 19.2 | 48.0 | 44.6 |
| BELGIUM........... | 28.7 | 33.5 | 36.8 | 38.5 | 40.4 | 46.8 | 51.4 | 46.9 | 51.9 | 60.2 |
| CANADA............ | 57.8 | 70.5 | 78.6 | 78.8 | 62.8 | 81.4 | 106.6 | 114.7 | 125.0 | 127.2 |
| DENMARK........... | 7.3 | 11.6 | 11.9 | 12.4 | 11.8 | 15.0 | 15.7 | 16.7 | 20.6 | 25.2 |
| FINLAND........... | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 |
| FRANCE............ | 34.0 | 39.8 | 47.2 | 49.0 | 60.8 | 90.4 | 88.9 | 90.9 | 99.5 | 109.2 |
| GERMANY, FED REP... | 53.0 | 52.0 | 68.9 | 69.6 | 67.7 | 77.7 | 88.2 | 89.7 | 104.5 | 135.0 |
| GREECE............ | 0.9 | 0.3 | 1.0 | 0.4 | 0.0 | 0.9 | 1.3 | 1.1 | 0.3 | 1.4 |
| IRELAND........... | 0.8 | 2.2 | 3.5 | 2.4 | 3.5 | 4.2 | 4.1 | 5.2 | 8.1 | 8.5 |
| ISRAEL............ | 2.7 | 4.2 | 4.8E | 5.2 | 3.6E | 3.4 | 2.4E | 1.2E | 0.2E | 0.2E |
| ITALY............. | 1.7 | 1.6 | 2.4 | 3.2 | 3.4 | 5.7 | 3.9 | 5.8 | 4.2 | 6.0 |
| JAPAN............. | 1.1 | 0.3 | 0.9 | 0.5 | 0.6 | 0.6 | 2.3 | 2.3 | 1.9 | 8.7 |
| NETHERLANDS........ | 62.0 | 67.3 | 74.3 | 74.8 | 73.7 | 80.2 | 93.3 | 87.1 | 96.0 | 105.4 |
| NEW ZEALAND........ | 1.2E | 2.3 | 2.5 | 2.5 | 2.6 | 3.8 | 2.5 | 3.2 | 4.6 | 7.7 |
| NORWAY............ | 21.5 | 23.8 | 18.6 | 18.6 | 21.6 | 27.4 | 27.1 | 28.7 | 31.1 | 38.2 |
| PORTUGAL.......... | 2.7 | 4.0 | 3.4 | 4.4 | 4.2 | 6.9 | 5.2 | 3.9 | 3.9 | 5.7 |
| SOUTH AFRICA....... | 0.1E | 0.1E | 0.2E | 0.6E | 0.6E | 0.6E | 1.0E | 1.0E | 1.0E | 1.0E |
| SPAIN............. | 0.2 | 0.7 | 0.2 | 0.1 | 0.0 | 0.2 | 0.1 | 0.0 | 0.6 | 0.8 |
| SWEDEN............ | 2.2 | 1.5 | 2.4 | 2.3 | 2.4 | 5.1 | 3.2 | 8.7 | 13.4 | 11.3 |
| UNITED KINGDOM..... | 12.7 | 28.2 | 35.7 | 38.0 | 60.4 | 78.9 | 88.5 | 90.8 | 89.9 | 87.4 |
| U.S.A.............. | 176.5 | 278.6 | 403.4 | 218.8 | 194.4 | 262.4 | 258.4 | 374.6 | 347.1 | 368.5 |
| DEVELOPING COUNTRIES........... | 20.3 | 22.9 | 26.4 | 34.4 | 39.5 | 53.1 | 61.7 | 59.5 | 69.3 | 82.1 |
| AFRICA............ | 3.2E | 3.2E | 2.8E | 3.4E | 2.9E | 3.8E | 4.2E | 3.2E | 6.2E | 3.8 |
| ALGERIA........... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.4 | 0.2 | 0.1 |
| CAMEROON.......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.7 | 0.1 |
| EGYPT............. | 1.9E | 1.5E | 1.4E | 1.6E | 2.0E | 1.7E | 1.5E | 1.5E | 1.5E | 2.0 |
| KENYA............. | 0.4 | 0.5 | 0.8 | 0.6 | 0.3 | 0.6 | 0.5E | 0.2 | 0.0 | 0.0 |
| MOROCCO........... | 0.9 | 1.2 | 0.6 | 1.1 | 0.3 | 1.1 | 1.4 | 0.9 | 1.2 | 1.2 |
| TUNISIA........... | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.2 | 0.7 | 0.2 | 0.6 | 0.4 |
| **AMERICA...........** | **0.5** | **0.6** | **1.5** | **1.8** | **1.5E** | **3.1** | **5.7E** | **6.3** | **6.7** | **9.1** |
| BOLIVIA........... | 0.0 | 0.0 | 0.1 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| COLOMBIA.......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 | 1.5 |
| DOMIN,REP.......... | 0.1 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| JAMAICA........... | 0.4 | 0.3 | 0.3 | 0.5E | 0.6E | 0.6E | 0.5E | 0.5E | 0.5E | 0.6 |
| MEXICO............ | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 1.7 | 4.2 | 5.7 | 6.0 | 6.8 |
| VENEZUELA.......... | 0.0 | 0.0 | 1.1 | 0.7 | 0.8E | 0.8 | 0.9E | 0.0 | 0.0 | 0.0 |
| **ASIA..............** | **13.5** | **18.7** | **22.1** | **28.9** | **34.6** | **44.5** | **51.5** | **49.7** | **55.0** | **67.5** |
| CYPRUS............ | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.5 | 0.6 | 0.4 | 0.9 | 1.3 |
| HONG KONG.......... | 6.3 | 8.2 | 10.2 | 14.5 | 16.4 | 19.1 | 18.2 | 18.1 | 21.3 | 25.5 |
| INDONESIA.......... | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 1.5 |

Table A.14 : EXPORTS OF ALUMINIUM WASTE AND SCRAP

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| JORDAN............. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 4.2 | 3.2 | 3.1 | 2.2 |
| KOREA REP.......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.4 | 0.3 | 0.0 |
| MALAYSIA........... | 1.7 | 2.6 | 3.0 | 3.3 | 3.2 | 6.1 | 6.4 | 7.1 | 9.0 | 8.0 |
| PAKISTAN........... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 |
| PHILIPP............ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.2 |
| SAUDI ARABIA....... | 1.1 | 1.5 | 2.0 | 4.1 | 6.9 | 7.7E | 9.0E | 7.0E | 5.0E | 5.0 |
| SINGAPORE.......... | 4.2 | 6.2 | 6.4 | 6.2 | 7.4 | 8.8 | 10.0 | 10.7 | 12.4 | 15.8 |
| TAIWAN............. | 0.0 | 0.0 | 0.3 | 0.2 | 0.4 | 0.9 | 2.0 | 2.7 | 3.0 | 8.0 |
| PAPUA NEW GUINEA... | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| EUROPE............. | 3.1 | 0.4 | 0.0 | 0.2 | 0.5 | 1.7 | 0.3 | 0.3 | 1.4 | 1.7 |
| YUGOSLAVIA......... | 3.1 | 0.4 | 0.0 | 0.2 | 0.5 | 1.7 | 0.3 | 0.3 | 1.4 | 1.7 |
| SOCIALIST COUNTRIES OF EASTERN EUROPE... | 123.0E | 76.4E | 57.2E | 82.1E | 77.4E | 81.3E | 100.0E | 110.2E | 130.0E | 175.5E |
| BULGARIA........... | 0.0 | 0.4E | 0.6E | 0.6E | 0.5E | 0.8E | 0.8E | 1.0E | 1.0E | 1.0E |
| CZECHOSLOVAKIA..... | 5.0E | 3.5E | 3.3E | 3.7E | 7.0E | 7.0E | 9.0E | 9.0E | 13.0E | 17.0E |
| GERMAN DR.......... | 12.0E | 9.6E | 4.0E | 4.1E | 7.2E | 7.0E | 8.0E | 8.0E | 10.0E | 15.0E |
| HUNGARY............ | 12.1 | 11.0 | 9.4 | 8.7 | 8.7 | 6.5 | 8.2 | 8.2 | 9.0 | 10.5 |
| POLAND............. | 15.0E | 18.4E | 7.5E | 4.0E | 3.0E | 3.0E | 4.0E | 4.0E | 7.0E | 12.0E |
| ROMANIA............ | 7.2E | 2.0E | 4.6E | 4.6E | 7.0E | 7.0E | 10.0E | 10.0E | 15.0E | 25.0E |
| USSR............... | 71.7E | 31.5E | 27.8E | 56.4E | 44.0E | 50.0E | 60.0E | 70.0E | 75.0E | 95.0E |
| SOCIALIST COUNTRIES OF ASIA............ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3E | 3.1E |
| CHINA.............. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3E | 3.1E |

Table A.15 : IMPORTS OF ALUMINIUM WASTE AND SCRAP

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD............... | 649.6 | 739.6 | 890.7 | 823.1 | 836.4 | 1058.6 | 1078.9 | 1220.3 | 1385.3 | 1529.8 |
| DEVELOPED MARKET ECONOMY COUNTRIES... | 615.3 | 703.6 | 864.9 | 805.5 | 805.5 | 1028.1 | 1053.1 | 1192.0 | 1340.5 | 1435.5 |
| AUSTRIA............ | 47.1 | 44.1 | 52.6 | 68.0 | 67.4 | 68.4 | 47.5 | 53.1 | 61.9 | 54.6 |
| AUSTRALIA.......... | 1.3 | 2.0 | 2.3 | 3.0 | 2.4 | 2.7 | 2.6 | 3.0 | 1.9 | 1.2 |
| BELGIUM............ | 15.4 | 26.6 | 33.3 | 39.1 | 51.2 | 53.1 | 58.0 | 62.7 | 71.3 | 90.9 |
| CANADA............. | 22.0 | 24.3 | 25.7 | 32.5 | 35.1 | 52.5 | 59.3 | 52.4 | 67.7 | 53.7 |
| DENMARK............ | 1.6 | 1.4 | 2.3 | 2.6 | 2.6 | 3.3 | 4.3 | 8.9 | 5.3 | 7.2 |
| FINLAND............ | 0.0 | 3.8 | 2.5 | 6.1 | 8.7 | 22.6 | 16.3 | 33.3 | 46.2 | 57.7 |
| FRANCE............. | 42.3 | 52.2 | 56.7 | 60.6 | 59.5 | 60.0 | 66.5 | 53.3 | 58.8 | 70.2 |
| GERMANY, FED REP... | 137.3 | 157.1 | 171.8 | 157.8 | 173.6 | 192.5 | 208.9 | 202.9 | 215.2 | 205.3 |
| GREECE............. | 0.0 | 0.1 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| IRELAND............ | 0.4 | 0.4 | 0.1 | 0.4 | 0.2 | 0.3 | 0.2 | 0.5 | 0.5 | 0.4 |
| ISRAEL............. | 0.7 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| ITALY.............. | 82.8 | 97.4 | 123.5 | 93.6 | 94.2 | 108.5 | 133.3 | 148.5 | 182.1 | 159.7 |
| JAPAN.............. | 139.6 | 181.5 | 275.7 | 204.9 | 181.7 | 302.0 | 243.3 | 361.1 | 358.8 | 430.6 |
| NETHERLANDS........ | 30.5 | 33.5 | 44.7 | 39.6 | 41.8 | 48.3 | 57.5 | 67.2 | 76.3 | 81.7 |
| NEW ZEALAND........ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 |
| NORWAY............. | 0.4 | 0.1 | 2.5 | 0.1 | 1.2 | 1.7 | 2.8 | 2.1 | 3.2 | 1.4 |
| PORTUGAL........... | 0.1 | 0.5 | 0.1 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| SOUTH AFRICA....... | 0.5 | 0.4 | 1.8 | 9.2 | 2.7 | 0.0N | 0.0N | 0.0N | 0.0N | 0.0 |
| SPAIN.............. | 3.1 | 4.1 | 5.6 | 5.8 | 8.9 | 10.1 | 6.0 | 9.1 | 19.1 | 16.1 |
| SWEDEN............. | 2.9 | 5.8 | 3.5 | 3.0 | 2.7 | 2.8 | 2.1 | 1.5 | 1.6 | 2.5 |
| UNITED KINGDOM..... | 5.0 | 6.3 | 5.8 | 4.0 | 4.1 | 10.9 | 6.7 | 4.8 | 7.8 | 12.6 |
| U.S.A.............. | 82.3 | 62.0 | 54.3 | 74.4 | 67.4 | 88.4 | 137.7 | 127.5 | 162.5 | 188.7 |
| DEVELOPING COUNTRIES........... | 29.2 | 34.5 | 25.3 | 16.8 | 28.8 | 30.1 | 25.3 | 27.3 | 43.9 | 93.1 |
| AFRICA............. | 1.6 | 2.1 | 2.3 | 1.2 | 0.5 | 0.9 | 0.1 | 0.3 | 0.4 | 0.2 |
| ALGERIA............ | 0.4 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 |
| BURKINA FASO....... | 0.0 | 0.0 | 0.5 | 1.1 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| CAMEROON........... | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 |
| COTE D'IVOIRE...... | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 |
| EGYPT.............. | 0.8 | 1.9 | 1.6 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MADAGASCAR......... | 0.0 | 0.1 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MALI............... | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MOROCCO............ | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| AMERICA............ | 22.3 | 22.8 | 11.4 | 5.3 | 4.8 | 5.8 | 2.4 | 2.5 | 6.5 | 8.4 |
| BRAZIL............. | 22.3 | 22.8 | 11.1 | 5.3 | 3.7 | 4.1 | 0.2 | 0.7 | 3.1 | 4.9 |
| CHILE.............. | 0.0 | 0.0N | 0.0 | 0.0 | 1.1 | 1.6 | 2.2 | 1.8 | 3.4 | 3.5E |
| COLOMBIA........... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| JAMAICA............ | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PERU............... | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ASIA............... | 5.3 | 9.6 | 11.6 | 10.3 | 23.5 | 23.4 | 22.8 | 24.2 | 36.8 | 84.4 |
| HONG KONG.......... | 0.5 | 0.5 | 1.1 | 0.6 | 0.7 | 1.1 | 1.1 | 0.9 | 1.3 | 3.1 |
| INDIA.............. | 0.0 | 0.3 | 3.3 | 2.1 | 0.6 | 0.9 | 0.2 | 1.3 | 1.0E | 1.0E |

Table A.15 : IMPORTS OF ALUMINIUM WASTE AND SCRAP

(Thousand metric tons)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| INDONESIA.......... | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JORDAN............. | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.1 | 0.2 | 0.0 | 1.0 | 0.7 |
| KOREA REP.......... | 3.8 | 5.3 | 3.9 | 5.7 | 7.3 | 6.1 | 5.1 | 5.6 | 8.8 | 43.2 |
| MALAYSIA........... | 0.0 | 0.0 | 0.3 | 0.3 | 0.5 | 0.7 | 0.6 | 1.3 | 1.3 | 0.8 |
| PAKISTAN........... | 0.0 | 0.0 | 0.0 | 0.0 | 12.2 | 13.9 | 14.7 | 13.6 | 21.8 | 28.0 |
| PHILIPP............ | 0.0 | 0.0 | 0.1 | 0.2 | 0.1 | 0.0 | 0.0 | 0.1 | 0.3 | 0.3E |
| SAUDI ARABIA....... | 0.1 | 1.5 | 1.5 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SINGAPORE.......... | 0.4 | 0.3 | 0.4 | 0.4 | 0.6 | 0.6 | 0.8 | 0.8 | 0.8 | 1.5 |
| THAILAND........... | 0.5 | 1.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.2 | 0.4 | 1.5 |
| TURKEY............. | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.4 | 0.1 | 4.3 |
| U.A.EMIRAT......... | 0.0 | 0.6 | 0.6 | 0.3 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **EUROPE.............** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.3** | **0.2** | **0.1** |
| YUGOSLAVIA......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 0.1 |
| SOCIALIST COUNTRIES OF EASTERN EUROPE... | 0.5 | 0.0 | 0.0 | 0.5 | 1.8 | 0.2 | 0.5 | 0.6 | 0.1 | 0.4 |
| CZECHOSLOVAKIA..... | 0.5 | 0.0 | 0.0 | 0.5 | 1.7 | 0.2 | 0.5 | 0.5 | 0.1 | 0.3 |
| GERMAN DR.......... | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| POLAND............. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 |
| SOCIALIST COUNTRIES OF ASIA............. | 4.6 | 1.5 | 0.5 | 0.3 | 0.3 | 0.2 | 0.0 | 0.4 | 0.8 | 0.8 |
| CHINA.............. | 4.5 | 1.5 | 0.5 | 0.3 | 0.0 | 0.2 | 0.0 | 0.4 | 0.8 | 0.8 |
| KOREA DPR.......... | 0.1 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Table A.16
International trade flows in bauxite
(thousand metric gross weight)

| Exporting reg \ Importing region | Developed market economy countries 1978 | Developed market economy countries 1987 | Latin American and Caribbean 1978 | Latin American and Caribbean 1987 | Other developing countries 1978 | Other developing countries 1987 | Socialist countries 1978 | Socialist countries 1987 | World 1978 | World 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| Developed market economy countries | 7012.0 | 4557.8 | 3.0 | 159.2 | 0.1 | 22.6 | 1214.4 | 821.6 | 8229.5 | 5561.2 |
| Latin American and Caribbean | 11930.2 | 7720.0 | 87.8 | 595.0 | 6.5 | 3.0 | -- | 1197.0 | 12024.5 | 9515.0 |
| Other developing countries | 10970.0 | 12585.7 | -- | 32.0 | 80.0 | 70.0 | 2504.1 | 4094.7 | 13554.1 | 16782.4 |
| Socialist countries | 86.5 | 552.2 | -- | -- | -- | 8.1 | 601.2 | 438.0 | 687.7 | 998.3 |
| World | 29998.7 | 25415.7 | 90.8 | 786.2 | 86.6 | 103.7 | 4317.9 | 6551.3 | 34495.8 | 32856.9 |

Source: UNCTAD secretariat.

Table A.17
International trade flows in alumina
(thousand metric tons actual weight)

| Exporting region \ Importing region | Developed market economy countries 1978 | Developed market economy countries 1987 | Latin American and Caribbean 1978 | Latin American and Caribbean 1987 | Other developing countries 1978 | Other developing countries 1987 | Socialist countries 1978 | Socialist countries 1987 | World 1978 | World 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| Developed market economy countries | 7700.1 | 8955.1 | 178.9 | 576.9 | 787.2 | 2312.4 | 141.4 | 413.7 | 8807.6 | 12258.1 |
| Latin American and Caribbean | 3367.2 | 3189.8 | 98.6 | 100.0 | 86.9 | 13.2 | 13.7 | -- | 3566.4 | 3303.0 |
| Other developing countries | 538.4 | 303.9 | -- | -- | 81.6 | 209.8 | 131.0 | 556.9 | 751.0 | 1070.6 |
| Socialist countries | 113.8 | 21.5 | -- | -- | 7.0 | 7.9 | 586.2 | 645.8 | 707.0 | 675.2 |
| World | 11719.5 | 12470.3 | 277.5 | 676.9 | 962.7 | 2543.3 | 872.3 | 1616.4 | 13832.0 | 17306.9 |

Source: UNCTAD secretariat.

Table A.18
International trade flows in unwrought aluminium
(thousand metric tons)

| Exporting region / Importing region | Developed market economy countries | | Latin American and Caribbean | | Other developing countries | | Socialist countries | | World | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 |
| Developed market economy countries | 2670.2 | 3998.7 | 91.8 | 28.4 | 228.6 | 618.2 | 170.4 | 35.3 | 3161.0 | 4680.6 |
| Latin American and Caribbean | 64.9 | 714.3 | 10.7 | 47.6 | 4.0 | 43.8 | -- | 7.3 | 79.6 | 813.0 |
| Other developing countries | 305.7 | 691.0 | 9.5 | 1.4 | 53.9 | 194.1 | 47.8 | 40.6 | 416.9 | 927.9 |
| Socialist countries | 253.9 | 285.2 | 1.2 | -- | 62.3 | 135.6 | 361.6 | 500.1 | 679.0 | 922.9 |
| World | 3294.7 | 5689.2 | 113.2 | 77.4 | 348.8 | 991.7 | 579.8 | 583.3 | 4336.5 | 7341.6 |

Source: UNCTAD secretariat.

Table A.19
International trade flows in semi-manufactured aluminium products
(thousand metric tons)

| Exporting region / Importing region | Developed market economy countries | | Latin American and Caribbean | | Other developing countries | | Socialist countries | | World | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 |
| Developed market economy countries | 1349.2 | 2401.7 | 81.6 | 84.0 | 258.1 | 304.7 | 49.7 | 50.5 | 1738.6 | 2840.9 |
| Latin American and Caribbean | 4.0 | 112.7 | 8.1 | 37.8 | -- | 0.5 | -- | -- | 12.1 | 151.0 |
| Other developing countries | 36.1 | 196.8 | 1.2 | 1.1 | 48.9 | 143.8 | 28.4 | 40.5 | 114.6 | 382.2 |
| Socialist countries | 24.0 | 34.0 | 2.8 | -- | 13.7 | 40.5 | 108.1 | 148.5 | 148.6 | 223.0 |
| World | 1413.3 | 2745.2 | 93.7 | 122.9 | 315.7 | 489.5 | 186.2 | 239.5 | 2013.9 | 3597.1 |

Source: UNCTAD secretariat.

Table A.20

Aluminium prices (London Metal Exchange, standard grade, cash) US cents/lb

| | | | | | |
|---|---|---|---|---|---|
| 1979 | I | 64.24 | 1985 | I | 49.44 |
| | II | 71.72 | | II | 49.11 |
| | III | 71.25 | | III | 45.59 |
| | IV | 83.68 | | V | 49.57 |
| 1980 | I | 93.20 | 1986 | I | 51.45 |
| | II | 81.31 | | II | 53.10 |
| | III | 78.60 | | III | 52.33 |
| | IV | 68.98 | | IV | 51.83 |
| 1981 | I | 65.42 | 1987 | I | 57.81 |
| | II | 58.91 | | II | 64.79 |
| | III | 54.07 | | III | 78.77 |
| | IV | 50.69 | | IV | 82.66 |
| 1982 | I | 48.82 | 1988 | I | 100.78 |
| | II | 43.68 | | II | 137.20 |
| | III | 43.47 | | III | 115.98 |
| | IV | 43.90 | | IV | 107.39 |
| 1983 | I | 54.55 | | | |
| | II | 64.71 | | | |
| | III | 71.63 | | | |
| | IV | 70.03 | | | |
| 1984 | I | 68.00 | | | |
| | II | 59.51 | | | |
| | III | 50.07 | | | |
| | IV | 49.57 | | | |

Table A.21
Latin American/Caribbean exports of bauxite (thousand metric tons, gross weight)

| | Latin American and Caribbean 1978 | Latin American and Caribbean 1987 | North America 1978 | North America 1987 | Europe 1978 | Europe 1987 | Japan 1978 | Japan 1987 | Developing countries 1978 | Developing countries 1987 | Socialist countries 1978 | Socialist countries 1987 | World 1978 | World 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | 4.0 | 1950.0 | — | 322.0 | — | 928.0 | — | — | — | — | — | — | 4.0 | 3200.0 |
| Dominican Republic | — | 243.0 | 756.7 | 81.0 | — | — | — | — | — | — | — | — | 756.7 | 324.0 |
| Guyana | 83.8 | 127.0 | 1192.2 | 736.0 | 367.3 | 152.0 | 34.6 | 12.0 | 6.5 | 3.0 | — | 285.0 | 1686.5 | 1315.0 |
| Haiti | — | — | 629.5 | — | — | — | — | — | — | — | — | — | 629.5 | — |
| Jamaica | — | — | 6447.8 | 3765.0 | — | — | — | — | — | — | — | 912.0 | 6447.8 | 4677.0 |
| Surinam | — | 148.0 | 2395.6 | 150.0 | 86.4 | 25.0 | 18.0 | — | — | — | — | — | 2500.0 a/ | 323.0 |
| Total | 87.8 | 2468.0 | 11421.8 | 5054.0 | 455.8 | 1105.0 | 52.6 | 12.0 | 6.5 | 3.0 | — | 1197.0 | 12024.5 | 9515.0 |

Source: UNCTAD secretariat.
a/ Estimate

Table A.22
Latin American/Caribbean exports of alumina (thousand metric tons, gross weight)

| | Latin American and Caribbean 1978 | Latin American and Caribbean 1987 | North America 1978 | North America 1987 | Europe 1978 | Europe 1987 | Japan 1978 | Japan 1987 | Developing countries 1978 | Developing countries 1987 | Socialist countries 1978 | Socialist countries 1987 | World 1978 | World 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | 0.5 | — | — | 87.0 | — | — | 0.3 | — | — | — | — | — | 0.8 | 87.0 |
| Guyana | 10.0 | — | 28.7 | — | 187.4 | — | — | — | — | — | — | — | 251.2 | — |
| Jamaica | 88.1 | — | 889.3 | 594.0 | 1013.8 | 850.0 | — | — | 86.9 | — | — | — | 2140.0 | 1444.0 |
| Surinam | — | 100.0 | 381.8 | 308.0 | 769.4 | 920.8 | 9.5 | — | — | 13.2 | 13.7 | — | 1174.4 | 1342.0 |
| Venezuela | — | — | — | 140.0 | — | 290.0 | — | — | — | — | — | — | — | 430.0 |
| Total | 98.6 | 100.0 | 1299.8 | 1129.0 | 1970.6 | 2060.8 | 9.8 | — | 86.9 | 13.2 | 13.7 | — | 3566.4 | 3303.0 |

Source: UNCTAD secretariat.

Table A.23
Latin American/Caribbean exports of unwrought aluminium (thousand metric tons)

| | Latin American and Caribbean 1978 | Latin American and Caribbean 1987 | North America 1978 | North America 1987 | Europe 1978 | Europe 1987 | Japan 1978 | Japan 1987 | Developing countries 1978 | Developing countries 1987 | Socialist countries 1978 | Socialist countries 1987 | World 1978 | World 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 1.1 | 5.9 | — | 18.6 | 2.3 | 15.5 | 0.2 | 32.4 | 4.0 | 0.5 | — | 0.1 | 7.6 | 73.0 |
| Brazil | — | 1.7 | — | 66.7 | — | 119.3 | — | 192.7 | — | 43.3 | — | 7.2 | — | 430.9 |
| Mexico | — | — | — | 3.1 | — | — | — | — | — | — | — | — | — | 3.1 |
| Surinam | — | — | 17.0 | — | 26.0 | 3.2 | 12.0 | — | — | — | — | — | 55.0 | 3.2 |
| Venezuela | 9.6 | 40.0 a/ | 7.0 | 45.0 | 0.4 | 40.6 a/ | — | 177.2 | — | — | — | — | 17.0 | 302.8 |
| Total | 10.7 | 47.6 | 24.0 | 133.4 | 28.7 | 178.6 | 12.2 | 402.3 | 4.0 | 43.8 | — | 7.3 | 79.6 | 813.0 |

Source: UNCTAD secretariat.
a/ Estimate.

Table A.24

Latin American/Caribbean exports of semi-manufactured products of aluminium (thousand metric tons)

| | Latin American and Caribbean | | North America | | Europe | | Japan | | Developing countries | | Socialist countries | | World | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 |
| Argentina | 0.5 | 2.0 | 1.1 | 4.9 | -- | 9.3 | -- | 1.6 | -- | -- | -- | -- | 1.6 | 17.8 |
| Brazil | 1.2 | 22.1 | 0.1 | 3.3 | -- | 0.8 | -- | 0.3 | -- | 0.5 | -- | -- | 1.3 | 27.0 |
| Chile | 0.1 | 0.2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.1 | 0.2 a |
| Colombia | 0.4 | 0.5 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.4 | 0.5 a |
| Costa Rica | 0.3 | 0.4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.3 | 0.4 a |
| El Salvador | 2.8 | 0.3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.8 | 0.3 a |
| Guatemala | 0.4 | 0.2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.4 | 0.2 a |
| Jamaica | 0.7 | 1.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.7 | 1.0 a |
| Mexico | 0.4 | 2.5 | 1.2 | 0.5 | -- | -- | -- | -- | -- | -- | -- | -- | 1.6 | 3.0 |
| Nicaragua | 0.8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.8 | -- |
| Peru | 0.2 | 0.3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.2 | 0.3 |
| Uruguay | 0.3 | 0.3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.3 | 0.3 |
| Venezuela | -- | 8.0 | 1.5 | 62.0 | -- | 28.5 | 0.1 | 1.5 | -- | -- | -- | -- | 1.6 | 100.0 |
| Total | 8.1 | 37.8 | 3.9 | 70.7 | -- | 38.6 | 0.1 | 3.4 | -- | 0.5 | -- | -- | 12.1 | 151.0 |

Source: UNCTAD secretariat.

Table A.25

Latin American/Caribbean exports of aluminium waste and scrap (thousand metric tons)

| | Latin American and Caribbean | | North America | | Europe | | Japan | | Developing countries | | Socialist countries | | World | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 | 1978 | 1987 |
| Dominican Republic | -- | -- | 0.1 | 0.2 | -- | -- | -- | -- | -- | -- | -- | -- | 0.1 | 0.2 |
| Jamaica | -- | -- | 0.4 | 0.6 | -- | -- | -- | -- | -- | -- | -- | -- | 0.4 | 0.6 |
| Venezuela | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Mexico | -- | -- | -- | 6.8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.8 |
| Colombia | -- | -- | -- | 1.5 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.5 |
| Total | -- | -- | 0.5 | 9.1 | -- | -- | -- | -- | -- | -- | -- | -- | 0.5 | 9.1 |

Table A.26

Production capacity for alumina grade bauxite in non-socialist countries in 1987 and changes until 1989 and 1995 (thousand metric tons gross weight per year)

| | End 1987 | Changes from 1987 to 1995 a/ Probable | Possible |
|---|---|---|---|
| DEVELOPED MARKET COUNTRIES | 44310 | +450 | +450 |
| Australia | 38750 | +2000 | +2000 |
| France | 1050 | -750 | -750 |
| Greece | 3710 | - | - |
| United States | 800 | -800 | -800 |
| DEVELOPING COUNTRIES | 50665 | +12515 | +22715 |
| AFRICA | 16400 | +1500 | +1500 |
| Ghana | 500 | - | - |
| Guinea | 14700 | +1500 | +1500 |
| Sierra Leone | 1200 | - | - |
| AMERICA | 24265 | +10915 | +20515 |
| Brazil | 7185 | +2965 | +7865 |
| Dominican Rep. | 450 | - | - |
| Guyana | 3050 | +2600 | +2600 |
| Jamaica | 8280 | +3450 | +5150 |
| Suriname | 4600 | - 400 | -400 |
| Venezuela | 700 | +2300 | +5300 |
| ASIA | 6400 | +100 | +700 |
| India | 3550 | +100 | +700 |
| Indonesia | 1800 | - | - |
| Malaysia | 550 | - | - |
| Turkey | 500 | - | - |
| EUROPE (Yugoslavia) | 3600 | - | - |
| WORLD TOTAL | 94975 | +12965 | +23165 |
| WORLD CAPACITY | 94975 | 107940 | 118140 |

Source: UNCTAD Secretariat

a/ Probable changes include expansion projects already realized as well as projects under construction, or where financing has been arranged. Possible changes also include other expansion projects that would be possible to realize until 1995.

Table A. 27
Production capacity for metallurgical grade alumina
in non-socialist countries in 1987 and changes until 1989 and 1995
(thousand metric tons gross weight per year)

| | End 1987 | Changes from 1987 to 1995 a/ Probable | Possible |
|---|---|---|---|
| DEVELOPED MARKET ECONOMY COUNTRIES | 19380 | +2285 | +2285 |
| Australia | 10250 | +550 | +550 |
| Canada | 1125 | - | - |
| France | 795 | -795 | -795 |
| Germany, Fed.Rep. | 840 | - | - |
| Greece | 600 | +600 | +600 |
| Ireland | 800 | +200 | +200 |
| Italy | 690 | - | - |
| Japan | 250 | - | - |
| Spain | 780 | +200 | +200 |
| United States | 3250 | +1530 | +1530 |
| DEVELOPING COUNTRIES | 8985 | +3685 | +6235 |
| AFRICA (Guinea) | 700 | - | - |
| AMERICA | 5975 | +3125 | +5675 |
| Brazil | 1356 | +825 | +1275 |
| Guyana | - | +300 | +400 |
| Jamaica | 1910 | +1300 | +1300 |
| Surinam | 1400 | - | - |
| Venezuela | 1300 | +700 | +2700 |
| ASIA | 1040 | +700 | +700 |
| India | 840 | +700 | +700 |
| Turkey | 200 | | |
| EUROPE (Yugoslavia) | 12700 | -140 | -140 |
| WORLD TOTAL | 28365 | +5970 | +8520 |
| WORLD CAPACITY | 28365 | 34335 | 36885 |

Source: UNCTAD Secretariat

a/ Probable changes include expansion projects already realized as well as projects uner construction, or where financing has been arranged. Possible changes also include other expansion projects that would be possible to realize until 1995.

Table A.28

Production capacity for non-metallurgical grade alumina in non-socialist countries in 1987 and probable a/ changes until 1995
(thousand metric tons gross weight per year)

| | End 1987 | Changes from 1987 to 1995 |
|---|---|---|
| Developed market economy countries | 2710 | +605 |
| Australia | 200 | +300 |
| Canada | 120 | |
| France | 300 | +425 |
| Germany, Fed. Rep. | 510 | -90 |
| Italy | 30 | |
| Japan | 640 | |
| Spain | 20 | |
| United Kingdom | 120 | |
| United States | 770 | -30 |
| Developing countries | 305 | +30 |
| Brazil | 150 | |
| India | 70 | +30 |
| Surinam | 35 | |
| Yugoslavia | 50 | |
| TOTAL | 3015 | +635 |

Source: UNCTAD secretariat

a/ Changes include expansion projects already realized as well as projects which are under construction or where financing has been arranged.

Table A.29

Production capacity for primary aluminium in non-socialist countries in 1987 and changes until 1995 (thousand metric tons per year)

| | End 1987 | Changes from 1987 to 1995 a/ Probable | Possible |
|---|---|---|---|
| DEVELOPED MARKET ECONOMY COUNTRIES | 10409 | +1104 | +2366 |
| Australia | 1062 | +204 | +794 |
| Austria | 92 | -80 | -80 |
| Canada | 1602 | +612 | +827 |
| France | 327 | +125 | +125 |
| Germany, Fed. Rep. | 738 | -47 | -47 |
| Greece | 147 | -23 | -23 |
| Iceland | 88 | +95 | +282 |
| Italy | 247 | -50 | -50 |
| Japan | 35 | - | - |
| Netherlands | 266 | - | - |
| New Zealand | 250 | - | - |
| Norway | 841 | +96 | +366 |
| South Africa | 170 | +5 | +5 |
| Spain | 351 | - | - |
| Sweden | 95 | +10 | +10 |
| Switzerland | 70 | -22 | -22 |
| United Kingdom | 281 | - | - |
| United States | 3747 | +179 | +179 |
| DEVELOPING COUNTRIES | 3464 | +2247 | +3722 |
| AFRICA | 463 | - | +120 |
| Cameroon | 84 | - | - |
| Egypt | 179 | - | - |
| Ghana | 200 | - | - |
| Libya | - | - | +120 |
| AMERICA | 1538 | +1280 | +2330 |
| Argentina | 150 | - | - |
| Brazil | 877 | +355 | +555 |
| Mexico | 66 | - | - |
| Surinam | 30 | - | - |
| Venezuela | 415 | +925 | +1775 |
| ASIA | 1090 | +923 | +1228 |
| Bahrain | 180 | +240 | +265 |
| India | 402 | +308 | +308 |
| Indonesia | 225 | - | - |
| Iran | 50 | - | +70 |
| Qatar | - | +240 | +240 |
| Republic of Korea | 18 | - | - |
| Saudi Arabia | - | - | +210 |
| Turkey | 60 | - | - |
| United Aran Emirates | 155 | +135 | +135 |
| EUROPE(Yugoslavia) | 373 | +44 | +44 |
| WORLD total | 13873 | +3351 | +6088 |
| WORLD capacity | - | 17224 | 19961 |

Souurce: UNCTAD secretariat.

a/ Probable changes include expansion projects already realized as well as projects which are under construction or where financing has been arranged. Possible changes also include other expansion projects that would be possible to realize until 1995.