THE MINERAL INDUSTRY OF

ARGENTINA

By Pablo Velasco

In 1996, Argentina with a population of 35.6 million had a gross domestic product (GDP) of about $290 billion[1] with a per capita GDP of about $8,150. In GDP terms, Argentina ranks in the top 20 nations of the world. However, minerals and related industries, excluding hydrocarbons, accounted for less than 0.3% of the country's GDP. The value of Argentina's mineral production was about $750 million per year, with metallic mineral exports valued at about $40 million (Mining Journal, 1997, p. 33).

Of Argentina's $543 million total nonfuel mineral exports, construction materials exports represented 64.8%; nonmetallic minerals 27.5%; metallic minerals 7.4%; and semiprecious stones, 0.3%. On the basis of the scale of exploration and development interest in recent years, Argentina's mining officials predicted that the value of mineral production could reach $2.3 billion within 10 years; mineral exports could increase to as much as $1.4 billion per year. The 1995-99 5-year plan for the minerals sector has designed to help promote exploration and development. Exploration expenditure amounted to an estimated $80 million during 1996, with more than 180,000 meters (m) of drilling completed. By late 1996, 15 new projects were at an advanced stage, and feasibility studies were finalized for 6 or 7 of them.

The Argentine economy expanded by 4.4% in 1996 as the country pulled out of a yearlong recession. Expansion was strong in the final quarter, when economic activity was up 9.2% compared with the corresponding quarter of 1995. The economy is expected to continue to expand in 1997. The sale of Government assets is expected to cover the fiscal deficit of $2.5 billion created by the agreement between the Argentine Government and the International Monetary Fund (IMF). IMF has authorized withdrawals of up to about $1.04 billion in stand-by credit during the next 21 months in support of the Government's 1996-97 economic and financial program. The Government expects to sell its nuclear power stations for $1 billion (Embassy of Argentina, Washington DC, 1996a).

Argentina's largest company, the oil and gas conglomerate Yacimientos Petroliferos Fiscales S.A. (YPF), has reported record earnings for its 1996 financial year, assisted by stronger oil prices and increased production of $817 million, up 3% from that of 1995. Privatized since 1991, YPF saw its market capitalization reach to more than $9 billion in assets (Embassy of Argentina, Washington DC, 1997a).

[1]Where necessary, values have been converted from Argentine pesos to U.S. dollars at the rate of 1.00 peso=US $1.00, the average exchange rate in 1996.

The minerals sector in Argentina has undergone a fundamental structural change, and the Government's minerals policy is now based on four strategic areas: encouraging private investment; ensuring protection for investors work; ensuring structural stability between the production of metals, nonmetallic minerals, and construction materials that can assist in modernizing the country's small-and medium-scale mining sectors; and promoting minerals-related activity that is compatible with sustainable development. Central and southern Argentina are self-sufficient in construction materials and some other nonmetallic minerals and are partly sufficient in gold, lead, silver, uranium, and zinc. Minerals imports, however, constitute a major portion of total import expenditures, and the Government's efforts are geared toward minerals import dependency in the near future. Apart from construction materials, the principal commodities now mined in Argentina are borates, coal, lead, precious metals, uranium, and zinc.

Government Policies and Programs

Argentina's Legal Framework for mining covers an abstract of the Mining Code, Legal Framework for the Investment in Argentina, Mining Investment Law No. 24,196, Regulating Law of Mining Investment (Decree No. 2686/93), Mining Reorganization Law No. 24,224, Federal Mining Agreement Law No. 24,228, VAT Funding Law No. 24,402, Regulation of the Law No. 24,402 (Decree No.779/95), Mining Updating Law No. 24,498, and Environmental Protection for the Mining Industry, Law No. 24,585.

The Mining Code, approved by the Argentine Congress on November 25, 1986, regulates the rights, obligations, and procedures for the acquisition, exploitation, and utilization of mineral substances. It has undergone several amendments, the latest being laws Nos. 24,402/94 (Financing Regime for the Payment of Value Added Tax) and its Regulatory Decree 779/95, 24,498/95 (Mining Updating), and 24,585/95 (Environmental Protection) (Directorio de Oportunidades, 1996, p. 56).

Environmental Issues

The Environmental Protection Mining Code Law No. 24,585 was approved by Congress on November 1, 1995, and was enacted on November 21.

Article 1: Section 282 of the Mining Code has been replaced by the following: "Clause 282: Miners may exploit their claims freely, without being subject to any regulations other than those relative to their safety, the police power, and the preservation of the environment. The protection of the environment and the conservation of the natural and cultural resources within the area of mining activities remain subject to the provisions of the Supplementary Section and to those that are duly established by virtue of Section 41 of the National Constitution." Article 2: The following is incorporated as a Supplementary Section before the final Section of the Mining Code. This "Supplementary Section" Environmental Protection for the Mining Industry will cover the following Chapters: areas of application and scope, environmental procedure instruments, environmental preservation and protection regulations, liability for environmental damages, infringements and penalties, environmental education and protection, and general and temporary provisions.

Production

Argentina continued to be the world's third largest producer and exporter of boron minerals and byproducts after the United States and Turkey. The number of minerals produced has decreased during the past 20 years. Output of tin and tungsten ceased following the crisis of the mid-1980's, and the production of iron ended in 1990. Iron ore now constitutes the largest single component of mineral imports. Argentina was self-sufficient in construction materials (rocas de aplicación) and some other nonmetallic minerals. In the industrial mineral sector, the largest growth was in mining construction materials, whose production value has increased by almost 60% since 1990. Production of semiprecious stones rose to rise to $2 million from $5,000 in 1992. Argentina also produces gold, lead, silver, uranium, and zinc. About total of some 900 mining companies are in operation; of these about 640 are involved exclusively in the production of construction materials. Most Argentina mining companies are small, employing fewer than 50 persons each with the exception on Mina Aguilar and Bajo de la Alumbrera in Jujuy and Catamarca provinces respectively.

Argentina's only primary aluminum producer, Aluminios Argentinos, S.A.I.C. (ALUAR), produced about 190,000 metric tons per year (t/yr) of aluminum ingot, billet, and slab. Crude steel production increased 0.9% in 1996 to about 3.65 million metric tons (Mt), while domestic consumption increased to 3.1 Mt from 2.7 Mt in 1995. The largest producers of steel in Argentina were Aceros Paraná S.A. (formerly Sociedad Mixta Siderúrgica Argentina) and ACINDAR-Industria Argentina de ACEROS S.A., which were privatized in 1993. Production of crude oil increased nearly 16.3% in 1996 and refinery products remained about the same as that of 1995. *(See table 1.)*

Trade

According to the preliminary edition of mining statistics released by the Dirección de Evaluación Minera de la Secretaría de Industria, Comercio y Minería of Argentina reported that the value of exported metallic minerals, mineral-related products, and industrial minerals, including construction materials, amounted to $543 million, an increase of 5.9% compared with that of 1995. The value of exported metals was about $40.2 million, a decrease of 4.9% compared with that of 1995. The export value of nonmetallic minerals was $149.5 million, an increase of 20.8% compared with that of 1995. The value of construction materials was $351.8 million, an increase of 1.9%, compared with that of 1995, and a national participation of about 65%. The export value of precious stones was $1.5 million, which was the same as that of 1995. The export value crude oil and refinery products was $790 million, an increase of 8.8% compared with that of 1995; small quantities of crude oil and refinery products were exported to the United States. (Estadistica Minera de la Republica Argentina, Edicion Preliminar 1994-1996 p.2-3). The principal nonfuel mineral exports were classified on the basis of their export value as follows: borates, 25.9%, of which sodium borate was 13.4%, boric acid, 10.3%, and boron minerals 2.2%; metals, 23.5%, of which refined zinc was 23.0% and refined lead, 0.5%; metallic minerals, 22.5%, of which lead minerals were 19.4% and zinc minerals, 3.1%; granites, 12.0%, of which manufactured was 11.6% and granite in blocks, 0.4%; and others, 16.1%. In 1996, the nonfuel minerals and mineral-related products were exported to 51 countries, including: Brazil, 30.5%; the United States, 15.1%; Belgium, 12.7%; Japan, 8.6%; Chile, 6.1%; Uruguay, 5.1%; Morocco, 4.7%; and Bolivia, 1.1%.

Minerals imports, however, constitute a major portion of total import expenditures, and Argentina is making significant efforts to reduce this in the near future. The total amount of steel imported reached 1.281 Mt, of which 65% was from Brazil, 10% from Poland, 5% from South Africa, and the remainder from other countries. In l996, the steel industry had to import about 1.8 Mt of iron ore and concentrate, for a total value of $61.1 million, and 993,000 metric tons of coal for the coke plants, for a value of $66.4 million. Exports of minerals would be more than triple by 2000, to about $1 billion from the current $26 million, according to the Argentine Secretary of Mining and Industry (Estadistica Minera de la Republica Argentina, Edicion Preliminar 1994-1996. p.2-3).

Structure of the Mineral Industry

The Secretary of Mining and Industry, a unit of the Ministry of Economy and Public Works, defines and controls the tasks performed by the National Mining Board and the National Geological Service Board. The Secretary of Mining and Industry promotes and coordinates mining technology policy, establishes the development and incorporation of new technologies, and monitors and preserves a single data bank of mining and geologic information.

Following a privatization process in 1996, the nuclear powerplants formerly under La Comisión Nacional de Energía Atómica are privately operated by Nucleoélectrica Argentina S.A.. The construction of the third nuclear powerplant Atucha II has been discontinued owing to budgetary constraints.

The mineral industry in the private sector comprises several mining and manufacturing companies, such as ALUAR, Cementos Loma Negra C.I.A.S.A., Cía. Boroquímica S.A.M.I.C.A.F., Cía. Minera Aguilar S.A., Cía. Minera Tea

S.A.M.I.C.A.F., and Sulfacid S.A.C.I.F.

In 1996, the largest copper and gold mining company, Minera Alumbrera Ltd., continued construction of a mine and concentrator in Catamarca Province; production is scheduled to start in 1997, after which output will reach 180,000 t/yr of copper and 20,800 kilograms per year (kg/yr) of gold. Additionally, hundreds of small metallic and industrial mineral companies were engaged in mining activities throughout Argentina. *(See table 2.)*

At yearend, 10.9 million people were employed nationwide, of which 7,000 were in the cement industry, 36,000 in the metallurgical plants, 16,000 in the mining sector, and 21,000 in the oil and gas industry.

Commodity Review

Metals

Aluminum.—Primary aluminum was produced by ALUAR, whose refinery in Puerto Madryn, Chubut Province, had an installed production capacity of 190,000 t/yr. In 1996, ALUAR was studying the possibility of a bond issue to fund a $300 million expansion of the plant refinery at Puerto Madryn to be completed by July 1999. The expansion will boost its refined aluminum output by 35.8% to 258,000 t/yr, ALUAR official said. Additional output will be powered by a 120-(MW) combined-cycle thermoelectric generator to be acquired by ALUAR. The extra output shall be sold to export markets. ALUAR already exports about two-thirds of its current output, much of it to Chile and Japan. In 1995, complex imported in 1995 about 350,000 t of alumina feedstocks from Aluminum Company of America with about one-half coming from Australia and one-half from Brazil.

Copper and Gold.—The Bajo de la Alumbrera copper-gold project is being constructed in the Province of Catamarca in northwestern Argentina on behalf of a joint venture between Yacimientos Mineros de Agua de Dionisio (YMAD) and Minera Alumbrera Ltd.. The project is being developed by Minera Alumbrera Ltd., a company owned equally by Mount Isa Mines (MIM) Holding Limited of Australia and International Musto Explorations, itself owned by North Limited of Australia (50%) and Rio Algom Ltd. of Canada (50%). Property ownership rests with YMAD, which retains a 20% net proceeds royalty interest in the project. Construction work on the project started in 1995, and concentrate production is scheduled to begin in 1997. The copper concentrate from this deposit will be thickened to a soupy slurry (65% solids) that will be pumped 245 kilometers (km) to the filtration plant near Tucumán. At the filtration plant, the water will be removed from the concentrate until a moist (9% moisture) powdered copper concentrate suitable for dry handling is created. By 2000, this will be the 9th largest copper project in the world, with 190,000 t/yr of copper production, and the 14th largest gold mine, with 22,706 kg/yr of gold production. It will be the largest gold producer in South America and have the largest mills in use for mineral processing. The present mine plan addresses the first 20 years of the mine life based on processing 752 Mt of ore and hauling an additional 1,149 Mt of waste rock from the pit. The total copper production is forecast to be 3.3 Mt and the total gold production is forecast to be 370,000 kilograms (kg). The open-pit mine will use state-of-the-art techniques and the largest available equipment. For 4 years, extraction will be from a high-grade starter pit with ore grades averaging 0.76% copper and 1.0 gram per ton (g/t) of gold. The quality of the ore is expected to decrease over the first 20 years, averaging 0.51% copper and 0.64 g/t of gold. (Minera Alumbrera Ltd.,1996).

CAR Exploration Pty. Ltd. of Australia also completed an option agreement with Yacimientos Mineros Riojanos S.E.M. (YAMIRI) of La Rioja Province to explore the well-known Famatina copper deposit in northwest in Argentina.

In late September, the Canada's Cambior Inc. announced completion of the feasibility study for the El Pachón copper project in Argentina. The project is owned 50% by Cambior, the managing partner, and 50% by Cía. Minera an José S.A.. Cambior reported estimated mining reserves at El Pachón to be 880 Mt at 0.62% copper, 0.015% molybdenum, 0.02 g/t gold, and 2.41 g/t silver. The mine plan shows higher grades of 0.81% copper in the first 5 years of operation, producing 250 million metric tons per year (Mt/yr) of copper in concentrate, with mine-site cash costs of 28 cents per pound of copper in concentrate. Total capital cost was estimated to be $900 million. Copper concentrate will be delivered via pipeline 164 km to a filter plant on the Chilean coast. Cambior is looking for equity partners in the El Pachón project, with a view to completing the process by yearend 1997. By 1999, Pachón is expected to be among the world's major copper sources.

Situated in Catamarca Province, the Agua Rica porphyry copper deposit is a joint venture between BHP Minerals International and Northern Orion Exploration with 70% and 30% interests, respectively. Drilling to date indicates that high-grade mineralization extends more than 1,576 m from east to west and more than 485 m from north to south. The resource potential of Agua Rica was estimated to be 1.2 billion metric tons of ore grading 0.5% copper and 0.22 g/t gold as well as molybdenum credits. The calculation, based on 39 holes, was made in February 1996. Since that time, infill drilling has been carried out in an effort to verify the grade. A new estimate will be based on 103 holes.

Gold and Silver.—The main sources of gold and silver production in 1996 were the Angela Mine in Chubut Province in the south, the Farallón Negro Mine in Catamarca Province in the northwest, and other properties in the mining district owned by YMAD, a company partially owned and controlled by the Province of Catamarca and the Argentine Government. The company, a mineral producer, was seeking private partners to explore about 25 square kilometers, including the Farallón Negro and the Alto de la Blenda Mines. These mines have been producing some 600 kg/yr of gold and 7 t/yr of silver. The Angela Mine, an underground operation owned by Cerro Castillo S.A., produced silver, gold, and some base metals.

One of the most interesting developments in gold and silver exploration was in the southern Province of Santa Cruz where

Minorco-Perez Companac is to bring its Cerro Vanguardia gold-silver property into production by 1998 at a cost of $180 million. The project was expected to yield 6 t/yr of gold and 60 t/yr of silver in doré. Minera Mincorp S.A.'s feasibility study was completed in 1995; construction was due to start by the end of 1996. Open-pit mining and conventional carbon-in-pulp leaching were envisaged, with an anticipated mine life of 15 years. An environmental impact plan approved by officials will be monitored on a yearly basis. Minera Mincorp is owned 50%-50% by Minorco and the Argentine industrial group Parez Companac.

Argentina Gold Corp. (ARP) and Barrick Gold were planning an extensive exploration program at their jointly owned Veladero and Del Carmen properties located on the Argentine side of the El Indio gold belt of Chile. The 1996-97 program consists of grid sampling, geologic and mineral alteration mapping, and geophysical measurements, and will be followed by about 9,000 m of drilling to evaluate areas of hydrothermal alteration for large, bulk tonnage, and/or high-sulfide bonanza-type gold ore bodies. At Veladero, where ARP holds 60% equity and is operator, several highly altered epithermal and hydrothermal areas have been outlined, with the main precious metal targets being Cerro Pelado and Veladero Sur. At Del Carmen, 60% owned by Barrick, the area is thought to be a geologic extension of Barrick's Tambo and El Indio deposits in Chile.

Tin.—Sunshine Mining and Refining Co. plans to more-than-double its exploration efforts at the Pirquitas property in northwestern Argentina. The company plans to spend $2.8 million on expanded drilling and metallurgical programs. The drilling will be conducted at an increased density, which the company hopes will allow it to upgrade a significant portion of the resource into a proven and probable reserve category. During the second half of 1996, Sunshine undertook 7,600 m of diamond drilling and 10,300 m of reverse-air drilling. To date, Sunshine has identified a resource of 47.5 Mt at a grade of 0.49% tin and 204 g/t silver. The deposit is still open at depth and along strike and is believed by company officials to have significant additional potential. This will be evaluated so that a decision can be made between open-pit or underground mining methods. Company officials report a conservative value of the Pirquitas project (minimum of $200 million) at this early stage (Southern Miner, 1996).

Iron and Steel.—Production of iron ore in 1995 was limited to about 310 t from Neuquén, and in 1996, production was shut down. Argentina imported 4.9 Mt of iron ore concentrate from Brazil (99%) and Sweden (1%). Hierro Patagónico Argentino S.A., the new company in charge of the Sierra Grande Mine, announced that an evaluation study of the former Hierro Patagónico Sociedad Anonima Minera installation was completed. The study was conducted by Lurgie Metallurgical of Germany, which found the installation highly satisfactory, thus opening up a new perspective for reactivating the entire operation of the company.

Crude steel production increased slightly to about 3.65 Mt compared with that of 1995, and output of semimanufactured products remained about the same (3.7 Mt). Meanwhile, apparent domestic consumption of rolled steel products was estimated by the Siderurgical Industry Center of Argentina to be about 3.2 Mt, a decrease of about 20% compared with that of 1995 and a per capita consumption of about 90 kg.

In the almost 3 years since privatization, Aceros Zapla is in the process of financial and technological restructuring. Andina S.A.I.C., the Argentine ferroalloys producer, was planning to revamp its fourth 18-MW furnace to produce silicon metal. An upgrade of the furnace, which has a capacity of 8,000 to 8,500 t, will be about 4 months. At present, Argentina does not produce any silicon and imports its silicon requirements from Brazil (Metal Bulletin, 1996).

Uranium.—Preliminary figures released by the Secretary of Industry, Commerce, and Mines indicated that the production of yellow cake uranium (U_3O_8) in 1996 was about 27,000 kg, or 60% lower than that of 1995.

Argentina had two operational nuclear powerplants—Atucha I and Embalse Rio Tercero. Atucha II is under construction but will use the same source of domestic uranium oxide fuel for its power reactor. Argentina's Senate passed a bill in late December to pave the way for the privatization of Argentina's nuclear powerplants. The plants, grouped under Nucleoeléctrica Argentina S.A., are Embalse, Atucha I, and the yet-to-be-completed Atucha II. Atucha I has a capacity of 350 MW and Atucha II will have almost double that. Embalse has a capacity of 648 MW.

Industrial Minerals

Boron.—Borax S.A. is the country's leading producer of borates from its operations in the salars of the Andean region, while the U.S. company, FMC Corp., has invested about $65 million since 1991 to bring lithium deposits in the far northwest of Argentina into production.

Argentina ranked third in the world in boron mineral production with output of borates amounting to about 342,000 t, 39.7% higher compared with that of 1995. The main deposits are in the Provinces of Catamarca, Jujuy, and Salta in the Argentine Andes.

The total installed boric acid production capacity in Argentina was about 30,000 t/yr, but currently, most of the plants are on standby. The main producer was Norquímica S.A. with 5,400 t/yr. Exports of boric acid were about 11,000 t in 1996.

Cement.—According to statistics released by the Portland Cement Manufacturers' Association, Argentina's production of cement declined by 6%, to 5.1 Mt, compared with that of 1995. The decline was due to decreases in consumption and in the demand for exports and to an increase in demand for imports. During 1996, the cement industry operated at about 52% of its installed capacity. The average consumption of cement per capita increased from 143 t to 156 t in 1996. Total installed production capacity of about 12 Mt/yr was far in excess of the current domestic requirements. Argentina's cement companies are headed by Loma Negra, which has an installed cement production capacity of about 8 Mt/yr at nine plants. Juan Minetti S.A. will invest $90 million to build a factory that produces clinker (the raw material for the manufacture of cement) in La Malagueña in the province of Córdoba. To finance the undertaking, Minetti signed an agreement with International Finance Corp. and the Madrid branch of the Deutsche Bank. The agreement will allow the cement manufacturer to increase production to 1.2 Mt/yr by 1998.

Lithium.—One of the newest and most-significant industrial mineral projects in South America came on-stream in November 1996 when U.S.-based FMC Corp. brought its Fenix lithium project into production. The operation is based on brines drawn from the Salar del Hombre Muerto, about 850 miles (1,370 km) from Buenos Aires in the Argentine Andes and the first major lithium mine outside of Chile and the United States. Cía Minera Altiplano S.A., wholly owned by U.S.-based FMC, has invested about $45 million since 1991 developing the first stage of the project. Salar del Hombre Muerto is on an ancient dry evaporated lake bed about 4,000 m (13,200 feet) above sea level in the Andes. Clays suitable for the construction of evaporating ponds were found on site. The extraction process requires large volumes of freshwater drawn from a lake fed by two nearby rivers. Initially, work will be done on the brine flow to ensure smooth-running in the system, and commercial products are expected to be on-stream in the first quarter of 1997. The new mine is expected to produce between 9,000 and 18,000 t/yr of lithium salts when in full production. FMC has been pleasantly surprised by the high quality of the brines, the low magnesium ratio, and the lack of impurities. In test production, lithium yields where as high as 85%; as a result, the project size was scaled up from 14,000 to about 20,000 t/yr. Reserves were estimated to be sufficient for 70 years.

Potassium.—Through its subsidiary CAR Exploration Argentina S.A., CAR Ltd., has optioned the large undeveloped potash deposits along the Río Colorado, which forms the boundary between the Provinces of Mendoza and Neuquén. The current owner, Potasio Río Colorado S.A., a subsidiary of Minera TEA S.A., was seeking partners to help it develop a $100 million to $150 million potash project. In 1996, a prefeasibility study carried out by CAR was based on the development of about 60 Mt of recoverable potassium chloride at a rate of 2 Mt/yr. CAR decided not to proceed with its option to earn an 80% stake in the project after it announced the merger with Rio Tinto Zinc Corp. Ltd. (RTZ). Potassio Río Colorado, meanwhile, was looking to develop the deposit by using solution mining, followed by evaporation and cold crystallization. This smaller scale project was anticipated to recover around 750,000 t/yr of potash within 5 years of coming onstream.

The reserves at the Río Colorado deposit consisted of a high-grade sylvite ore and were estimated to contain more than 1 billion metric tons of potash (Mining Magazine, 1997).

Mineral Fuels

In 1996, Argentina's estimated production of commercial energy totaled about 82.3 Mt of standard coal equivalent. Of the total energy produced, liquid fuel oils, 54.4%; natural gas, 38.4%; and hydropower, 7%; solid fuels accounted for only 0.2%. Energy consumption data were not available for years subsequent to l993, when the total consumption was 68.9 Mt of standard coal equivalent. Natural gas, 49.2%; liquid fuels, 40.8%; hydropower, 8.7%; and Solid fuels provided 1.3%. Of the total installed electrical generating capacity of 18,035 MW in 1993, 55.6% was thermal, 38.8% was hydroelectric, and 5.6% was nuclear. In that year, the latest for which complete data were available, a total of 63,038 kilowatt hours was produced, 49.4% by thermal plants, 38.3% by hydroelectric plants, and 12.3% by nuclear plants. In September 1994, the $7 billion Yacyretá hydroelectric power project generated its first electricity after 20 years of work on the Paraná River between northern Argentina and Paraguay; the project was owned by the governments of both countries. In 1996, YPF S.A. posted net profit of $ 817 million, up 3% from that of 1995.

Coal.—Production of bituminous coal reached 200,000 t, down 5% from 1995. Yacimientos Carboníferos Fiscales, the state-owned coal company, produced coal from the Río Turbio Mine in Santa Cruz Province. The production of coal in Argentina is due to cease in 2000 when the current contract ends between the Río Turbio Mine, and the privatized Central Termoeléctrica powerplant in San Nicolás, which was privatized by government. The extraction of coal from the Río Turbio Mine is currently limited owing to the abundant, cheaper, and better quality of imported coal and to the closer sources of natural gas in the region that are making Argentina a gas-producer power with capacity for export (Latinominería, 1997).

Natural Gas.—Gross production of natural gas in 1996 was maintained at about 27 billion cubic meters. Proven reserves of natural gas were reported by the recently privatized YPF to be about 620 billion cubic meters; most natural gas produced in Argentina was controlled by YPF. About 53% of the gas was produced by YPF, and the rest, either imported from Bolivia or produced under service contracts with private production companies. Gas imports from Bolivia in 1996 amounted to more than 2 billion cubic meters, valued at $94 million.

Natural gas has been a magnet for direct investment in recent years. [From pipelines (Enron Corp. participates in the Transportadora de Gas del Norte and Transportadora de Gas del Sur (TGS) pipelines, respectively), to local gas distribution, to petrochemicals and fertilizers]. The abundance and low cost of natural gas is expected to attract U.S. companies. In petrochemicals, Dow Chemical recently invested $400 million to acquire majority stakes in Petroquímica Bahía Blanca and Indupa. Given the scale of petrochemical investments, the natural endowments of Argentina, and the upbeat mood in the international petrochemical market, this industry's potential for generating investment looks promising (Embassy of Argentina, Washington DC, 1997c).

For $60 million, TGS is increasing capacity at the General Cerri gas-processing plant by a net 17 million cubic meters per day and with an storage capacity of 45,000 cubic meters. To build these facilities from scratch would cost as much as $150 million. TGS is South America's largest gas pipeline company and processes most of the natural gas in Argentina. Transportation capacity is 54 Mm^3/d through three major pipelines—one from southern Argentina and two from the west.

YPF is becoming the largest provider of natural gas to the southern cone of Latin America. It already has a contract to supply natural gas to the Canadian Methanex metane plant in Punta Arenas, in the extreme Austral part of Chile, and another one to the Gas Andes consortium, which operates the gas pipeline under construction between Mendoza Province, Argentina, and Santiago, the capital of Chile (Latinominería, 1997a). Recently, YPF announced that it will be the natural gas provider to Enron's thermal central powerplant to be constructed in the northern part of Mato Grosso State, Brazil, to produce electricity for that State (Latinominería, 1997b).

A consortium led by Gaz de France has been awarded a contract to distribute natural gas in five northern Argentine provinces. The consortium will invest about $150 million during the next 5 years to bring natural gas to the Provinces of Chaco, Corrientes, Entre Ríos, Formosa, and Misiones. Gaz de France, with a 70% stake, leads the group, which also includes energy company Bridas Corp., with 15% and others with the balance (Embassy of Argentina, Washington DC, 1997c).

Petroleo Brasileiro S.A. of Brazil, YPF, and U.S. Dow Chemical Co. have launched a major gas-processing/natural gas liquids (NGL) utilization project in Argentina and Brazil. The program calls for total use of NGL being produced in Argentina's Neuquén Basin. The three firms will spend $630 million during the next 3 years on development that is to start sometime in 1997. The project entails construction and operation of a 35.7-million-cubic-meter-per-day gas processing plant at Loma de la Lata, Argentina, to recover ethane, propane, butane, and natural gasoline from Neuquén Basin gas. The NGL will be transported via a 600-km pipeline to a fractionation plant to be built at Bahía Blanca, the ethane will be sold to Dow's petrochemical complex at Bahía Blanca, and the gasoline and propane-butane mix will be exported to Brazil. YPF will hold 38%; Petrobrás, through its subsidiary Brasoil, 34%; and Dow, 28%. The processing plant will guarantee a supply of 516,000 t/yr of methane for the Bahía Blanca petrochemical complex, as well as 615,000 t/yr of liquefied petroleum gas and 188,000 t/yr of natural gasoline for exportation to Brazil (Oil & Gas Journal, 1997).

Petroleum.—The boom resulting from the deregulation and privatization of major Argentine industries opened up the oil industry to exploration and production. As a result, oil production has increased in recent years. According to YPF, oil production in 1996, was 286 million barrels, an increase of about 8% compared with that of 1995. The company, which accounted for 43% of the total production, opened up several central and secondary areas to the private sector.

Argentine oil companies YPF and Astra CAPSA, which is controlled by Spain's Repsol, have signed a contract to purchase 67% of oil company Mexpetrol Argentina S.A. for $204 million. In a letter to the Buenos Aires Stock Exchange, Astra said that each had paid $102 million for the acquisition. Astra agreed to buy 95.4% of Algas S.A. and an 89% stake in Poligas Lujan S.A., both marketers of LPG, for a total of $75 million (Embassy of Argentina, Washington, DC, 1997d).

Infrastructure

Inadequate infrastructure was an important constraint to mining development in Argentina. The existing railroad network, owned and operated by the state enterprise, Ferrocarriles Argentinos, covered about 34,000 km. The railway system did not reach the mining areas, and the road system in the mining provinces was underdeveloped. The major industrial centers and national ports are at great distances from the mining areas, raising the costs of inputs, marketing, and power and water supply. Mining companies either connected to a regional power system or installed their own. Water supply was an even more serious problem than power supply, as much of the present and potential mining activity was located in arid areas. Finally, the isolated location of mining operations required the establishment of fully developed mining camps. Roads were one of the principal transport methods used to move mine production to processing plants in Buenos Aires and other shipping centers. Argentina has 11,000 km of navigable inland waterways and an excellent navigable river system. River transport operates largely on the Río de la Plata estuary and its tributaries: in the Paraná, Paraguay, Alto Paraná and Uruguay Rivers.

In 1996, Argentina had about 4,090 and 2,900 km of pipelines to transport crude oil and refined products, respectively, and 9,918 km of gas pipelines from production centers to consumer centers. The system connected oilfields and refineries to the north, center, west, and southeast with main industrial centers. The pipeline to transport crude oil from the Neuquén Basin, Argentina, to Concepción, Chile, across the Andean Range was under construction at yearend. Natural gas was imported from Bolivia by a gas pipeline through Yacuiba-Pocitos at the border to the northern provinces and Buenos Aires. Copper concentrate from the Alumbrera gold-copper project will be pumped 245 km to the filtration plant near Tucuman. This concentrate will be loaded onto rail wagons for transport to a new port facility near Rosario City. At the port, the concentrate will be loaded on ships for transport to international smelters.

Outlook

Argentina's energy resources, which are abundant and diverse, include crude oil, natural gas, hydropower, coal, and uranium; the potential has not been fully determined. New investments in Argentina are directed toward several promising projects, including copper, gold, crude oil, gas pipelines, natural gas, and petrochemicals. Significant copper projects currently being evaluated include Cerro Amarillo, consisting of seven properties that lie in the southern extension of Chile's El Teniente copper belt. Discovered in 1964, the El Pachón deposit in San Juan province, which has been estimated to hold about 520 Mt grading 0.75% copper, is the subject of a study by Canada's Cambior and Bolivia's Comsur. The deposit lies directly east of the Los Pelambres Mine in Chile at an altitude of 4,500 m. Australia's Western Mining Corp. is in the process of exploring Argentina Gold's Río Frio, La Poposa, and Olivares properties in San Juan Province. La Poposa lies across the border from Barrick's El Indio and Tambo Mines in Chile.

National and provincial laws encourage the development of mining by private enterprises, including foreign companies. Several major mining companies and more than 60 junior companies are exploring the whole range of the Argentine Andean chain. Argentina's mineral resources will be important in the future of worldwide investment, development, and mineral-resource analyses.

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TABLE 1
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1992	1993	1994	1995	1996
METALS						
Aluminum:						
Primary		155,600	172,900 r/	175,000 r/	185,500 r/	185,900
Secondary		19,100 r/	14,400 r/	14,400 r/	10,000 r/	15,800
Beryllium, beryl concentrate, gross weight		-- r/	-- r/	--	--	-- e/
Cadmium concentrate:						
Gross weight		119	80	68	82	127
Cd content		37	25 r/	21 r/	25 r/	39
Columbium: Columbite concentrate: e/						
Gross weight	kilograms	-- r/	--	--	--	--
Cb_2O_5 content	do.	-- r/	--	--	--	--
Copper:						
Mine output, Cu content		297 r/	-- r/	-- r/	-- r/	-- e/
Refined e/		16,000 r/	15,000	16,000 r/	16,000 r/	16,000
Gold, mine output, Au content	kilograms	1,106 r/	937	937	837 r/	723
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	9 r/	3 r/	80 r/	--	-- e/
Fe content	do.	3	1 r/	28	--	-- e/
Metal:						
Pig iron	do.	966	984	998	1,496 r/	1,420
Sponge iron (direct reduction)	do.	1,027	1,156	1,266	1,334 r/	1,350
Total	do.	1,993	2,140	2,264	2,830 r/	2,770
Ferroalloys, electric-furnace:						
Ferromanganese		4,524	5,400	4,500	5,836 r/	6,000 e/
Ferrosilicomanganese		30,790	18,500	29,358 r/	27,344 r/	28,000 e/
Ferrosilicon		8,073	19,579	11,669 r/	9,000 e/	10,000 e/
Total		43,387	43,479	45,527 r/	42,180 r/ e/	44,000 e/
Steel, crude	thousand tons	2,700	2,886	3,300 e/	3,617 r/	3,650 e/
Semimanufactures 3/	do.	2,640	2,850	3,340 e/	3,670	3,700 e/
Lead:						
Mine output, Pb content		17,956	11,826	9,981	10,521	11,272
Metal:						
Smelter, primary e/		14,600 4/	14,600	14,600	14,000	14,100
Refined:						
Primary		14,700 r/	12,473	7,785	2,430	396
Secondary		15,000	16,000	17,600	26,298	27,705
Total		29,700 r/	28,473	25,385	28,728	28,101
Manganese ore and concentrate:						
Gross weight		1,200 r/	-- r/	-- r/	-- r/	-- e/
Mn content e/		240 r/	-- r/	-- r/	-- r/	--
Silver:						
Mine output, Ag content	kilograms	45,374	42,744	38,032	47,787	50,399
Metal, smelter e/	do.	107,000	108,000	108,000	110,000	140,000
Tin: Metal, smelter		260 r/	129	100 e/	100 e/	100 e/
Uranium, mine output, U_3O_8 content	kilograms	146,000	148,000	94,000	68,000	27,000
Zinc:						
Mine output, Zn content		40,978	31,395	26,933	32,104	31,093
Metal: Smelter:						
Primary		34,492	31,070 r/	35,214 r/	35,767 r/	36,392
Secondary e/		2,800	2,500 r/	2,800 r/	2,800 r/	2,900
Total		37,292	33,570 r/	38,014 r/	38,567 r/	39,292
INDUSTRIAL MINERALS						
Asbestos		215	309	260 r/	300 r/ e/	446
Barite		10,015	14,761	27,828 r/	28,907 r/	14,038
Boron materials, crude		125,000	146,349	215,021	244,933	342,210
Cement, hydraulic	thousand tons	5,051	5,647	6,276 r/	5,447 r/	5,117
Clays:						
Ball clay (plastic clay) e/	thousand tons	100	100	90	90	90
Bentonite		97,531	96,706	313,407 r/	111,011 r/	134,588
Foundry earth		90,000 e/	96,709	119,179	120,000 e/	100,000 e/
Fuller's earth (decolorizing clay) e/		1,500	1,600	1,600	1,600	1,600
Kaolin		43,722	42,052	50,471	39,860 r/	64,241
Laterite (aluminous)		63,500	--	--	--	-- e/

See footnotes at end of table.

TABLE 1--Continued
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1992	1993	1994	1995	1996
INDUSTRIAL MINERALS--Continued						
Clays--Continued:						
Refractory e/		31,000	32,000	30,000	--	--
Other 5/	thousand tons	2,610	2,700 e/	2,600 e/	--	--
Diatomite		5,363	3,096	6,260	4,938 r/	8,647
Feldspar		48,509	55,764	42,516 r/	37,095 r/	72,539
Fluorspar		4,587	4,611	3,585	5,105 r/	5,666
Graphite		20	--	--	--	-- e/
Gypsum, crude		514,274	519,181	549,759 r/	590,055 r/	633,121
Lithium, spodumene, amblygonite, gross weight e/		620 4/	300	400	400	--
Mica:						
Sheet		373	720	720 e/	700 e/	297
Waste and scrap		635	1,226	1,104	4,341	1,840
Nitrogen, N content of ammonia e/		72,000	72,000	73,000	70,000	70,000
Phosphates, Thomas slag e/ 6/		50	50	50	50	50
Pigments, mineral, natural, other e/		40	28	-- r/	-- r/	--
Pumice and related volcanic materials (perlite, pozzolan, toba, etc.)		89,100	98,631	131,661 r/	74,941 r/	81,283
Salt:						
Rock e/	thousand tons	--	1	3	1	--
Solar	do.	952	1,033 r/	834 r/	1,009 r/	1,096
Total	do.	952	1,034 r/	837 r/	1,010 r/	1,096
Sand and gravel:						
Sand:						
Construction	do.	11,485 r/	16,246	14,368 r/	15,726 r/	16,628
Silica sand (glass sand)	do.	340	396	247	286	244
Gravel	do.	6,810	7,800	8,391 r/	5,819 r/	5,550
Soda ash e/		290	300	190 r/	200	200
Stone:						
Basalt	thousand tons	677	1,112	1,653	1,975 r/	1,133
Calcareous:						
Calcite, nonoptical		30,610 r/	34,513	49,900 r/	40,099 r/	40,011
Calcium carbonate (chalk)		17,000	19,000	20,000 e/	20,000 e/	20,000 e/
Dolomite		353,000	434,000	684,799 r/	1,107,906 r/	1,241,844
Limestone	thousand tons	10,800 e/	10,740	11,970	11,540 r/	12,315
Marble:						
Aragonite, broken		1,650	1,107	57 r/	-- r/	-- e/
Onyx, in blocks and broken		2,920	1,701	68 r/	122 r/	-- e/
Travertine, in blocks and broken		19,900	27,865	9,790	16,718 r/	22,800
Unspecified, in blocks and broken		22,000	24,426	15,338	8,440 r/	11,655
Flagstone		97,600	94,749	55,555 r/	87,576 r/	102,510
Granite:						
In blocks		53,900	87,337	88,215 r/	125,547 r/	113,456
Crushed	thousand tons	5,130	5,656	5,232 r/	7,030 r/	7,809
Quartz, crushed		106,204 r/	101,399	69,605 r/	95,121	130,951
Quartzite, crushed	thousand tons	400 e/	490	618	1,841	899
Rhodochrosite		-- r/	58	46	69	73
Gamestone (agate, amatist, apolo, turmalin, etc.)	kilograms	30,000 e/	4,963	4,800 r/	3,134	3,100
Sandstone e/		240	240	230	200	200
Serpentine, crushed		36,800	26,518	27,516 r/	78,107 r/	71,989
Shell, marl		237,000	247,928	238,037	869,650	883,990
Tuff, (tosca)	thousand tons	3,280	5,148	6,234	7,002	8,268
Strontium minerals, celestite		2,237 r/	4,806	8,484	9,325	3,775
Sulfates, natural:						
Aluminum (alum)		85,296 r/	29,240	131 r/	352	306
Magnesium (epsomite)		880 r/	2,820	1,160	720	1,440
Sodium (mirabilite)		24,796 r/	6,554	7,978	10,604	21,726
Talc and related materials:						
Pyrophyllite		3,020 r/	1,962	1,996	4,189	2,180
Steatite		425	840	500 e/	300 e/	300 e/
Talc		21,580 r/	18,084 r/	16,850 r/	12,474 r/	11,777
Total		25,025 r/	20,886 r/	19,346 r/	16,963 r/	14,257
Vermiculite		--	38	32	44	-- e/
Water, mineral-containing e/		140,000	140,000	130,000	135,000	135,000
Zeolite e/		95	90	90	90	90

See footnotes at end of table.

TABLE 1--Continued
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1992	1993	1994	1995	1996
MINERAL FUELS AND RELATED MATERIALS						
Asphalt and bitumen, natural (asphaltite)		310 r/	160	121	662	3,476
Coal, bituminous	thousand tons	212	200 e/	215 e/	210	200 e/
Coke, all types, including breeze e/	do.	820	800	200	300 4/	200
Gas, natural:						
Gross e/	million cubic meters	18,000	24,000	26,000	27,000	27,000
Marketed 7/	do.	19,100	21,500	22,100	22,000 e/	21,000 e/
Natural gas liquids:						
Butane	thousand 42-gallon barrels	3,770 e/	3,800	3,850 e/	3,847	3,850 e/
Propane	do.	4,560	4,600	4,600 e/	4,653	4,600 e/
Total	do.	8,330	8,400	8,450 e/	8,500 e/	8,450 e/
Peat, agricultural (turba)		1,179 r/	2,880	2,574 r/	4,000	2,692
Petroleum:						
Crude	thousand 42-gallon barrels	203,000	213,000	240,170	265,000 r/ e/	285,868
Refinery products:						
Gasoline	do.	30,700	31,200	31,200 e/	31,740 e/	31,750 e/
Kerosene	do.	2,610	2,400	2,400 e/	2,700 e/	2,750 e/
Jet fuel	do.	4,540	4,670	4,670 e/	4,700 e/	4,690 e/
Distillate fuel oil	do.	48,800	48,700	48,700 e/	49,700 e/	49,600 e/
Lubricants	do.	1,160	1,280	1,280 e/	1,200 e/	1,300 e/
Residual fuel oil	do.	28,600	27,800	27,800 e/	29,530 e/	29,540 e/
Other	do.	17,700	17,000	17,100 e/	18,350 e/	18,400 e/
Refinery fuel and losses	do.	1,040	--	-- e/	1,080 e/	1,070 e/
Total	do.	135,150	133,050	133,150 e/	139,000 e/	139,100 e/

e/ Estimated. r/ Revised.
1/ Table includes data available through Oct. 1997.
2/ In addition to the commodities listed, bismuth, carbon black, columbite, lime, natural gasoline, perlite, and potassium sulfate (kalinite) were believed to be produced, but output was not reported quantitatively, and available information was inadequate to make reliable estimates of output levels.
3/ Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.
4/ Reported figure.
5/ Includes plastic, semiplastic, and/or ferruginous clays used totally in the manufacture of portland cement.
6/ Thomas slag production was estimated from the Thomas crude steel reported in La Siderurgia Argentina annual, published by the Instituto Argentino de Siderurgia
7/ Includes natural gas imported from Bolivia.

TABLE 2
ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1996

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Aluminios Argentinos S.A.I.C. (ALUAR) (State, 52.1%; private 47.9%)	Puerto Madryn, Chubút Province	190.
Boron		Cía. Boroquímica S.A.M.I.C.A.F., (owned by Rio Tinto Zinc Corp. Ltd.)	El Porvenir Mine, Jujuy Province; Tincalayu and Campo Quijano, Salta Province	345.
Cement		Loma Negra C.I.A.S.A., #1; Juan Minetti, S.A., #2; Corporación Cementera Argentina, S.A., #3 (private, 100%)	Buenos Aires, Córdoba, Corrientes, Salta, San Juan, Mendoza, and Jujuy Provinces	6,000.
Coal		Yacimientos Carbóniferos Fiscales (Government, 100%) (will be privatized in 1997)	Río Turbio, Santa Cruz Province	210.
Copper and gold	kilograms	Minera Alumbrera Ltd. (Mount Isa Holding Ltd. of Australia, 50%; North Limited of Australia and Rio Algom Ltd. of Canada, 50%)	Bajo de La Alumbrera Mine, Belén Department, Catamarca Province.	180 Cu, 20,000 Au.
Gold and silver	kilograms	Yacimientos Mineros de Agua de Dionisio (YMAD) (Government, 100%), Angela Mine (private, 100%)	Farallón Negro, Hualfín and Belén Departments Gastre Department, Chubút Province	1,330 Au, 50,000 Ag.
Iron ore		Hierro Patagónico de Sierra Grade, S.A. Minera (HIPASAM) (Government, 100%) (shutdown partially in 1991	Sierra Grande, Río Negro Province	1,000.
Lead, silver, and zinc	kilograms	Cía. Minera Aguilar, S.A. (A Bolivian Consortium Cía. Minera del Sur. private, 100%	Estación Tres Cruces, El Aguilar, Jujuy Province	49,800 Ag, 24,000 Pb, 30,000 Zn.

TABLE 2--Continued
ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1996

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Natural gas	million cubic meters	Transportadora de Gas del Sur, S.A. (TGS) and Transportadora de Gas del Norte (TGN) both private	Neuquén Santa Cruz, Tierra del Fuego, Salta, and Río Negro Provinces	28,000.
Petroleum	million barrels	Yacimientos Petrolíferos Fiscales (YPF, S.A.) (partially private)	Chubút, Santa Cruz, Neuquén, Río Negro, Mendoza, Salta, Tierra del Fuego, Jujuy, La Pampa, and Formosa Provinces	240.
Steel		Aceros Paraná, S.A., (private, 79.9%; Government, 20.1%)	7 kilometers from San Nicolás de los Arroyos, Buenos Aires Province	3,300.
Do.		ACINDAR-Industria Argentina de ACEROS, S.A. (private, 100%)	Plant No.1, and 3, Buenos Aires Province; Plant No.2, near Río Paraná, Santa Fé Province	1,500.
Uranium (ore)		Empresa Nucleár Mendoza, subsidiary Nucleoélectrica Argentina S.A. (NASA)	Sierra Pintada, San Rafaél, Mendoza Province	160.
Zinc, refinery		Cía. Sulfacid S.A.C.I. y F (C.M.A.S.A., 50%; private, 50%)	Province	35.