THE MINERAL INDUSTRY OF

ARGENTINA

By Pablo Velasco

The Republic of Argentina, located in southern South America, has an area of about 2.8 million square kilometers (km^2). The area supported a population of 35.6 million in 1997 with a gross domestic product (GDP) per capita of $8,600[1] based on the 1996 purchasing power parity of $ 296.9 billion (1996 estimates). The 1997 GDP grew by 8.4%, reaching the highest level since the start of the Economic Transformation Program in 1991; in fact, the highest level ever recorded. Joining to the Mercado común del Sur (Mercosur) has been strongly beneficial for the national economy, particularly in terms of exports, which were worth some $28.75 billion in 1997. In recent years, mining has contributed less than 0.3% to the country's GDP. The annual value of Argentina's mineral production was about $750 million, with mineral exports valued at about $30 million (Mining Journal, 1998, p. 17).

Of Argentina's $543 million total nonfuel mineral exports, construction materials exports represented 65%; nonmetallic minerals, 28%; metallic minerals, 23.5%; 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, and mineral exports could increase to as much as $1.4 billion per year. The 1995-99 5-year plan for the minerals sector had been designed to help promote exploration and development. The unprecedented exploration boom, which began in 1991, and reached its peak in 1997, was due to fundamental changes in national mining legislation. According to the Secretary of Mining and Industry, exploration expenditures amounted to $110 million during 1996 and $181 million in 1997, with more than 181,000 meters (m) of drilling completed. Metals exploration by a smaller number of companies with long-term commitments to Argentina will continue.

Mercosur's main players, Brazil and Argentina, have so far survived the Mexican and the Asian currency crises, and both remain strong and growing. Argentina's Convertibility Plan, begun in 1995, is still working, with no talk of devaluation of the Argentine peso from its current value of one-to-one against the U.S. dollar. Inflation is at a historic low. Foreign investment in Argentina remains strong; with the current balance-of-payment deficit is due to the continued influx of capital goods. The country's biggest trading partner, Brazil, holds the key to Argentina's continued economic success in the near-term future, and if Brazil has economic problems, then the local effect in Argentina could be much worse than the aftermath of Asia and Mexico combined.

In an underpopulated country blessed with natural resources, mining is finally taking its place as a major part of Argentina's economy. Although behind agroindustrial production and beef, mine products will soon be among Argentina's top five exports but will have stiff competition from automobile exports and natural gas exports via five new pipeline projects to Chile. Mining's contribution is projected to increase to just under 1% of Argentina's GDP by 2000.

Apart from construction materials, the principal commodities mined in Argentina were borates, copper, lead, lithium brine, precious metals, uranium, and zinc.

Government Policies and Programs

The biggest mining news in 1997 was Catamarca Province's attempt to double the royalty applied to the Bajo de la Alumbrera Mine by interpreting the Federal 3% royalty cap to be a gross-product royalty rather than an after-cost royalty. Minera Alumbrera Ld. was making royalty payments in accordance with a provincial resolution that allowed the mine to stay within the after-cost royalty framework upon which the project's economies were originally based.

New mining legislation was proposed to clarify the current mining law. The first drafts, already passed through the National Senate. The proposed amendment itself would dramatically change existing laws by eliminating depreciation, or capital amortization, from the list of deductible costs despite recent international assurances to the contrary. If royalty and tax issues are not clearly settled at the national level, then further mining investment in Argentina on the scale of Bajo de la Alumbrera will be threatened. Problems continued in obtaining secure mining title in a timely fashion. Argentina lagged far behind Peru and Chile in meters drilled (and discoveries) during the recent boom years.

The cross-border mining treaty with Chile signed by both presidents as part of the Mercosur integration has not yet been approved by either Congress and will not be until the boundary dispute in southern Patagonia over the Hielos Continentales glacier field is settled. This is expected to take several years. Individual protocols are in-place for three major projects along the northern border. The Governments of Argentina and Chile signed a series of pacts resolving border disputes, lifting restrictions on land ownership, and affording the two countries access to each other's ports. Port access, in particular is ameliorating the problem of remoteness, encouraging infrastructure development and facilitating transport of capital goods and mine products. The two Governments were negotiating a mining integration treaty. It remains to be seen how this agreement will work in practice in these specific zones,

[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 1997.

although the long term outlook is excellent for the full implementation of this progressive treaty.

Argentina's Legal Framework for mining covers an abstract of the Mining Code, Legal Framework for 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, regulated the rights, obligations, and procedures for the acquisition, exploitation, and use of mineral substances. It has undergone several amendments, the latest being law No. 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).

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, 1995.

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.

As new mining environmental regulations are put into effect, comprehensive and workable government policies in Argentina will continue to have a balanced, progressive approach to mining in the 21st century.

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 constituted 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 mining sector, the largest growth was in mining of construction materials. The production value of which increased slightly to about 1.9%. Production of semiprecious stones rose 0.3% to about $1.5 million. Argentina also produced gold, lead, silver, uranium, and zinc. About 900 small mining companies were in operation; of these, about 640 were involved exclusively in the production of construction materials. Most Argentina mining companies employed less than 50 persons with the exception of the Aguilar Mine and the Bajo de la Alumbrera Mine in Jujuy and Catamarca Provinces, respectively.

Argentina's flagship mining project, Bajo de la Alumbrera, began production in September 1997, and is now one the top 15 copper-gold mines in the world. The deposit contains 767 million tons (Mt) of ore grading 0.51% copper and 0.64 grams per metric ton (g/t) of gold. Bajo de la Alumbrera was building up to a full production level of 180,000 metric tons per year (t/yr) copper and 19,906 kilograms per year (kg/yr) gold. By 2000, the mine is expected to move 325,000 metric tons per day (t/d) of ore and 140,000 t/d waste and to recover 2,000 t/d of copper-gold concentrate.

The primary aluminum producer, Aluminios Argentinos, S.A.I.C. (ALUAR), produced about 190,000 t/yr of aluminum ingot, billet, and slab. Crude steel production increased by 2.8% in 1997 to about 4.2 Mt, and domestic consumption increased to 3.7 Mt from 3.2 Mt in 1996. The largest producers of steel in the private sector of Argentina was Empresa Siderúrgica de Argentina (SIDERAR). Production of crude oil increased by nearly 6% in 1997, and refinery products remained at about the same level as that of 1996. *(See table 1.)*

Trade

According to the preliminary 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 export in 1997 amounted to $543 million, an increase of 5.9% compared with that of 1996. The export values of metals was about $40.3 million, a decrease of 4.9% compared with that of 1996; nonmetallic minerals was $149.5 million, an increase of 20.8% compared with that of 1996; construction materials was $351.8 million, an increase of 1.9% compared with that of 1996; precious stones was $1.5 million, which was the same as that of 1996; and crude oil and refinery products was $790 million, an increase of 8.8% compared with that of 1996. Small quantities of crude oil and refinery products were exported to the United States (Estadística Minera, 1997).

In 1997, 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, constituted a major portion of total import expenditures, and Argentina was making significant efforts to reduce there imports. 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 l997, 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 (t) of coal for the coke plants, for a value of $66.4 million. Exports of minerals would be more than tripled by 2000, to about $1 billion from the current $26 million, according to the Argentine Secretary of Mining and Industry (Estadística Minera, 1997).

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 comprised 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., Minera Alumbrera.

Additionally, hundreds of small metallic and industrial mineral companies were engaged in mining activities throughout Argentina. *(See table 2.)*

Other mining projects to be completed in the near future were the Bajo de la Alumbrera expansion; the Fenix-Salar del Hombre Muerto, the Cerro Vanguardia, the Rio Colorado, El Pachón, the Agua Rica, the San Jorge, the Sunshine Pirquitas, Las Flechas, and the El Carmen.

At year-end, 10.9 million people were employed nationwide, 7,000 of whom 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 Argentina's ALUAR in Puerto Madryn, Chubut Province, at an installed production capacity of about 186,000 t/yr. In 1997, ALUAR's smelter expansion was going smoothly, according to officials. The 124 new cells are expected to start producing in April 1999 and to produce an additional 72,000 t/yr of aluminum for the export market. When the plant reaches full capacity after the expansion, it will produce 258,000 t/yr of aluminum. (Metal Bulletin, 1998, p.5). Additional output will be powered by a 120 megawatt (MW) combined-cycle thermoelectric generator to be acquired by ALUAR in 1999.

Copper and Gold.—The Bajo de la Alumbrera copper-gold project was being constructed in the Province of Catamarca on behalf of a joint venture between Yacimientos Mineros de Agua de Dionisio (YMAD) and Minera Alumbrera Ld. The project was being developed by Minera Alumbrera, a company owned by MIM Holdings Ltd. (50%), Australia's North Limited (25%), and Rio Algom Ltd (25%).

Property ownership rested with YMAD, which retained a 20% net proceeds royalty interest in the project. Construction work on the project started in 1995, and concentrate production started on September 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. The Bajo de la Alumbrera consistently produced its 80,000 t/d of ore throughput design capacity, even exceeding it by 5,000 tons per month. About 30% of Alumbrera's long-term contracts were sold to Asian countries. By 2000, this could 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.

Two projects were on hold waiting for improvements in project economics that will only come with a stronger copper price. One is El Pachón copper project on the Chilean border in San Juan Province immediately adjacent to Anaconda's Los Pelambres Mine in Chile. The project is equally owned by Canada's Cambior, the managing partner, and Cía. Minera San José S.A. The use of Chilean infrastructure is integral to the project's viability, and existing infrastructure in Chile will provide the main access for supplies to El Pachón, and it has been proposed that the copper concentrate from the project will be transported by a 164-km-long slurry pipeline to a filter plant at Los Vilos, on the coast of Chile, for shipment overseas. Also, a new access road from Chile, along with a 2.2 km tunnel through the mountain ridge separating Argentina from Chile, will be constructed to link up the existing public road system in Chile. The second project is El Pecan, which Cambior reported estimated mining reserves to be 880 Mt, grading 0.62% copper, 0.015% molybdenum, 0.02 g/t gold, and 2.41 g/t of 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 $0.28 per pound of copper in concentrate. Total capital cost was estimated to be $900 million. Cambior was looking for equity partners in El Pecan project, with a view to completing the process by yearend 1997. By 1999, El Pecan is expected to be among the world's major copper sources.

BHP Minerals International said that it will retain at least a 40% controlling interest in the Agua Rica copper project in Argentina and will remain the operator. BHP had a 70% interest, and Northern Orion Exploration, based in Vancouver, owned the other 30%. Agua Rica copper project is located in Catamarca Province. Northern reported a positive initial feasibility study for Agua Rica, estimating measured, indicated, and inferred reserves of 1,600 Mt at a 0.2% copper cut-off, grading 0.44 % copper, 0.19 g/t gold, 3.01 g/t silver and 0.03% molybdenum. BHP estimated

the cost of the project's construction to be more than $1 billion, a figure similar to that of the nearby Bajo de la Alumbrera copper-gold mine. (Mining Journal, 1997, p. 465).

Gold and Silver.—In 1997, the main sources of gold and silver production were from small mines in Jujuy Province in the north, the Farallón Negro and the Bajo de la Alumbrera Mines and other properties in the mining district of Catamarca Province in the northwest, owned by YMAD. The company was seeking private partners to explore about 25 square kilometers, including the Farallón Negro and the Alto de la Blenda. These mines have been producing about 700 kg/yr of gold and 50 t/yr of silver.

One of the most interesting developments in gold and silver exploration was in southern Province of Santa Cruz where Minorco-Perez Companc will bring its Cerro Vanguardia gold-silver property into production by 1998 at a cost of $180 million. The project was set to begin production in October 1998 and was expected to produce at the rate of 51.4 kg/yr of silver and 6.8 kg/yr of gold from a minable reserve of 9.1 Mt, grading 113 g/t silver and 9.7 g/t gold. The estimated project cost was $225 million. Cerro Vanguardia was owned by Minorco (46.25%), Perez Companc (46.25%), and Formicruz, a Santa Cruz Provincial company (7.5%). Open-pit mining and conventional carbon-in-pulp leaching were proposed; mine life was anticipated to be 15 years. An environmental impact plan approved by government and mining officials will be monitored on a yearly basis. Minera Mincorp was equally owned by Minorco and the Argentine industrial group Perez Companc.

Argentina Gold Corp. (ARP) and Barrick Gold Corp. were planning an extensive exploration program at their jointly owned Veladero and Del Carmen properties located on the Argentine side of El Indio gold belt of Chile. The 1996-97 program consisted of grid sampling, geologic and mineral alteration mapping, and geophysical measurements and it will be followed by about 9,000 meters (m) of drilling to evaluate areas of hydrothermal alteration for large, bulk tonnage, and/or high-sulfide bonanza-type gold ore bodies. The Vancouver-based Junior company ARP holds 60% and Barrick's (40%) of El Veladero gold discovery, which lies 400 km north of San Juan in western Argentina, near the Chilean border. ARP was the operator. The Junior company recently collared hole 55 on the Filo Federico target, which represents a large geophysical anomaly coincident with an alteration zone and a geochemical anomaly. The hole intersected 168 m, grading 2.7 g/t gold, and ended in strong mineralization. Hole 56, was drilled as a twin to hole 55, and intersected 303 m, grading of 1.2 g/t gold and 14.02 g/t silver. At El Carmen, owned by Barrick 60%, the area is thought to be a geologic extension of Barrick's Tambo and El Indio deposits in Chile. Specifically, the recent discovery by ARP on its Veladero project has led to the increased exploration focus on El Valle del Cura area of El Indio Gold Belt in San Juan Province.

Opawica Exploration Inc. announced that its wholly owned subsidiary Opawica Argentina S.A. has reacquired an option to earn up to a 100% interest in the Los Despoblados, La Ortiga Norte, Los Bañitos, the Arroyo Sepultura, and Las Máquinas properties covering an aggregate area of approximately 23,000 hectares (ha). Los Despoblados is located approximately 10 km southeast of the ARP/Barrick Veladero gold discovery. (Northern Miner, 1997 p. 4).

Iron and Steel.—Production of iron ore at Neuquén in 1996 and 1997 was slowed down; in 1995, it had been limited to about 310 t. 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 in 1997 that an evaluation study of the former Hierro Patagónico Sociedad Anonima Minera installation had been completed. The study was conducted by Lurgie Metallurgical of Germany, which found the installation to be highly satisfactory, thus opening up a new perspective for reactivating the entire operation of the company.

Crude steel production increased by 4% to about 4.19 Mt compared with that of 1996, and output of semimanufactured products increased by about 1.4%, to 3.7 Mt. Meanwhile, that the apparent domestic consumption of rolled steel products was the Siderurgical Industry Center of Argentina estimated to be about 3.9 Mt, an increase of about 4%, compared with that of 1996. The per capita apparent consumption of steel was 135 kilograms (kg) or 11.5% higher that of 1996.

During the almost 3 years since privatization, Aceros Zapla has been 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. Argentina did not produce any silicon and imported its silicon requirements from Brazil (Metal Bulletin, 1996).

Tin.—Sunshine Mining and Refining Co. planned to more than double its exploration efforts at the Pirquitas tin and silver property in northwestern Argentina. Low silver prices, however, took their toll on the company, which posted a net loss of $24.8 million in 1996 compared with a $15.4 million loss in 1995. Meanwhile, infill drilling and underground sampling were under way at the company's newly discovered Pirquitas tin and silver property in Argentina. The program is expected to provide information for a bankable feasibility study scheduled to start later this year. The project contains more than 300 million ounces of silver resources and was envisaged as a large, low-cost open pit mine. The average silver price in 1997 was $4.86 per ounce, compared with $5.11 per ounce in 1996. During the second half of 1996, Sunshine undertook 7,600 m of diamond drilling and 10,300 m of reverse-air drilling. Sunshine identified a resource of 47.5 Mt, grading 0.49% tin and 204 g/t silver. The deposit was open at depth and along strike and was believed by company officials to have significant additional potential. (Northern Miner, 1997, p. 19). Sunshine was active on the Huemules gold-silver property in Chubut Province where three gold-bearing veins have been identified. Land holdings in Argentina exceeded 40,000 ha (Mining Journal, 1996, p.18).

Uranium.—Preliminary figures released by the Secretary of Industry, Commerce, and Mines indicated that the production of yellow cake uranium (U_3O_8) in 1997 was about 30,000 kg, or 11% higher than that of 1996.

Argentina had two operational nuclear powerplants—Atucha I and Embalse Rio Tercero. Atucha II was under construction and

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., were Embalse, Atucha I, and the yet-to-be-completed Atucha II. Atucha I had a capacity of 350 MW, Embalse had a capacity of 648 MW, and Atucha II will have almost double the capacity than Atucha I.

Industrial Minerals

Boron.—Borax S.A. was the country's leading producer of borates from its operations in the salars of the Andean region. Argentina ranked third in the world in boron mineral production, with output of borates amounting to about 370,000 t, or 8.1% higher compared with that of 1996. The main deposits were in the Provinces of Catamarca, Jujuy, and Salta.

The total installed boric acid production capacity in Argentina was about 30,000 t/yr, but most of the plants were on standby. The main producer was Norquímica S.A., with 5,400 t/yr. Exports of boric acid were about 11,000 t in 1997.

Cement.—According to statistics released by the Portland Cement Manufacturers' Association, Argentina's production of cement increased by 34%, to 6.9 Mt, compared with that of 1996. The boom in the cement sector is tied to the good performance of the private construction industry, which was recovering to levels seen before the Mexican devaluation and was expected to flourish in 1998. During 1997, the cement industry operated at about 57% of its installed capacity. The average consumption of cement per capita increased to 160 t from 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 were headed by Loma Negra, which had 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, Córdoba Province. 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 The Fenix-Salar del Hombre Muerto lithium project into production. FMC, which was a major world supplier of lithium chemicals, controls the large lithium brine deposit in Catamarca Province. Development was ongoing, and the extraction plant was expected to be completed in early 1997. Since 1991, FMC has invested about $80 million to bring lithium deposits in northwestern Argentina into production.

The company was planning to recover lithium carbonate from brines in the Fenix-Salar del Hombre Muerto, where the new mine when in full production was expect to produce between 9,000 and 20,000 t/yr of lithium salts. The deposit is located at about 1,370 km from Buenos Aires in the Argentine Andes and was the first major lithium mine outside of Chile and the United States. Cía. Minera Altiplano S.A., wholly owned by FMC, has invested about $80 million developing the first stage of the project. The Salar del Hombre Muerto is on an ancient dry evaporated lake bed about 4,000 m above sea level in the Andes. Clays suitable for the construction of evaporating ponds were found on site. The extraction process will require large volumes of freshwater drawn from a lake fed by two nearby rivers. Initially, work was done on the brine flow to ensure smooth running in the system, and commercial products were expected to be on stream in 1997. FMC was pleasantly surprised by the high quality of the brines, the low magnesium ratio, and the lack of impurities. In test production, lithium yields were as high as 85%; as a result, the company will initially produce 20,000 t/yr of lithium carbonate and lithium chloride. The products will probably be transported by rail to the Chilean port of Antofagasta. About 98% of the lithium will be exported, and 2% will be sold domestically. According to company officials reserves were estimated to be sufficient for about 70 years. The new lithium carbonate plant came on stream in the last half of 1997 and will be followed by lithium chloride production in 1998.

Potassium.—In 1996, CAR Ltd. optioned the large undeveloped potash deposits along the Rio Colorado through its subsidiary CAR Exploration Argentina S.A. The deposits forms the boundary between Mendoza and Neuquén Provinces. 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). The potash deposit 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. Potasio Rio Colorado is 17% owned by the Inter-American Investment Bank. Miner TEA is a private mining company, with an annual revenue of about $20 million derived from limestone and dolomite quarrying and lime production. (Mining Journal, 1997)

In 1996, a prefeasibility study carried out by CAR Exploration was based on the development of about 60 Mt of recoverable potassium chloride at a rate of 2 Mt/yr. In 1997, CAR Exploration 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. (ROZ). Potassic Rho Colorado, meanwhile, was looking to develop the deposit by using solution mining, followed by evaporation in solar pools and cold crystallization. This smaller scale project was expected to produce about 750,000 t/yr of potash within 5 years of coming on stream.

Mineral Fuels

Argentina's estimated production of commercial energy totaled about 82.3 Mt of standard coal equivalent. Of the total energy produced, liquid fuel oils accounted for 54.4%; natural gas, 38.4%; hydropower, 7%; and solid fuels, 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. Of the 18,035-MW total installed electrical generating capacity in 1993, 55.6% was thermal; 38.8%, hydroelectric, and 5.6%, nuclear. In 1992, the latest for which

complete data was 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, after 20 years of work, the $7 billion Acarid hydroelectric power project on the Paraná River between northern Argentina and Paraguay; generated its first electricity; after 20 years of work, the project was owned by the governments of both countries. In 1997, Yacimientos Petroliferos Fiscales (YPF S.A.) posted a net profit of $877 million, up by 7.3% from that of 1996.

Coal.—In 1997, production of bituminous coal was 200,000 t, which was same as that of 1996. Yacimientos Carboníferos Fiscales (YCF) the state-owned coal company, produced coal from the Rho 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 YCF mine and the Central Termoeléctrica powerplant in San Nicolás, which was privatized by the Government in 1997. Extraction of coal from the mine was 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 with capacity for export (Latinominería, 1997a).

Natural Gas.—Gross production of natural gas in 1997 was maintained at about 35 billion cubic meters. Proven reserves of natural gas were reported by the recently privatized YPF to be about 246 billion cubic meters; About 53% of the natural gas in Argentina was produced by YPF, and the rest, either imported from Bolivia or produced under service contracts with private production companies. Natural gas imports from Bolivia in 1997 amounted to more than 2.4 billion cubic meters, and where valued at $98 million.

Natural gas represented an important and growing market for YPF in Argentina and neighboring countries. YPF was in a strong competitive marketing position because of its extensive long-lived reserves and dominant position in basins close to major population centers. 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 looked promising. YPF continued its program to develop natural gas reserves to support a pipeline to Brazil. The company added reserves in the Acambuco (22.5%) and Aguarague (30%) joint-venture blocks, as well as in the Chango Norte and the Porcelana areas. In the Neuquén Basin, an oil discovery was made at Loma Negra (Area Rio Negro Norte). Late in the year, a gas exploration program began at Loma de la Lata and in the center of the Neuquén Basin. In the Golfo San Jorge Basin, drilling was successful in deep targets in the Cañadón de la Escondida field. During 1997, YPF continued to evaluate underground natural gas storage capacity as part of a long-term program designed to meet peak seasonal gas demand and was developing projects at Las Flores, Province of Buenos Aires, San Jerónimo, Province of Santa Fe, and Lulunta Carrizal, Province of Mendoza. YPF sales of natural gas to Chile through the Gas Andes pipeline system where expected to begin in August 1998 and could average 1,600 M/m^3 during the second half of the year. PF.'s greatest growth potential lay in the export market. To that end, the company undertook aggressive marketing efforts in Brazil, northern and southern Chile and Uruguay.

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).

Petroleo Brasileiro S.A. of Brazil, PF., and U.S. Dow Chemical Co. have launched a major gas-processing/natural gas liquids (NGL) utilization project in Argentina and Brazil. The program called for the total use of the NGL being produced in the Neuquén Basin. The three firms will spend $630 million during the next 3 years on development that is to start in 1997. The project entailed construction and operation of a 35.7-million-cubic-meter-per-day gas-processing plant at Loma de la Lata, 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 Province, 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.—Production of crude oil in 1997 was 305 million barrels, an increase of about 10.5%, compared with that of 1996. The company, which accounted for 55% of the total production, opened up several central and secondary areas to the private sector.

Secondary recovery operations grew to 36% of total oil production from 26% in 1996. Year-end crude oil reserves remained at 2.6 billion barrels. PF. revenues and net income reached record levels, with net income increasing for the fourth consecutive year to $877 million on revenues of $6,144 million despite a decline in international crude oil prices. Earnings benefitted from excellent operating performances in every unit, record domestic and international crude oil production, higher volumes of diesel and lubricants sold, and improved use in their refineries. In 1997, YPF began exporting gasoline for resale in the United States retail market. In one large development, Amoco Argentina and Bridas Corp. merged most of their South American assets. Amoco and Bridas has interests of 60% and 40%, respectively, in a combined firm operating in Argentina, Bolivia, Brazil, Chile, Paraguay, Peru, and Uruguay. As part of the deal, Bridas acquired a minority interest in Amoco Bolivia, which owns 50% of Empresa Petrolera Chaco S.A. The deal which created Argentina's second largest oil and gas producer after YPF, included production of more than 140,000 barrels per day (b/d) of oil equivalent (boe) and 1.5 billion (boe) of reserves, about half of which are proved.

In 1997, YPF, participated in 98 exploratory wells compared with 74 wells in 1996.

Infrastructure

Inadequate infrastructure was an important constraint to mining development in Argentina. The railway system consisted of

34,572 km, which did not reach the mining areas, and the road system in the mining provinces was underdeveloped. Because the major industrial centers and national ports are at great distances from the mining areas, the costs of inputs, marketing, and power and water supply were very high. Consequently, mining companies either connected to a regional power system or installed their own. Water supply was an even more serious problem because 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 had 11,000 km of navigable inland waterways and an excellent navigable river system. River transport operated largely on the Río de la Plata estuary and its tributaries—the Paraná, the Paraguay, the Alto Paraná and the Uruguay Rivers.

In 1997, 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. At a cost of $60 million Transportadora de Gas del Sur S.A. (TGS) is increasing capacity at the General Cerri gas-processing plant by a net 17 million cubic meters per day (Mm^3/d).

TGS transportation capacity was 54 Mm^3/d through three major pipelines—one from the southern Argentina and two from the west. Copper concentrate from the Alumbrera gold-copper project was pumped to a filtration plant 245 km away from Tucumán. This concentrate was loaded onto rail wagons for transport to a new port facility near Rosario City. At the port, the concentrate was 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, gold, silver, lithium carbonate, and potassium chloride projects 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, El Pecan copper deposit in San Juan Province, which has been estimated at about 880 Mt, grading 0.62% copper, is the subject of a study by Canada's Cambior and Bolivia's Cía. Minera del Sur (Comsur). The deposit lies directly east of Anaconda's 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 Rio 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. Other deposits, include the Agua Rica copper and gold deposit in Catamarca Province, Cerro Vanguardia, the gold and silver deposit in Santa Cruz Province, the Fenix-Salar del Hombre Muerto lithium deposit in Catamarca Province and the San Jorge, copper and gold deposit in Mendoza Province.

Argentina welcomes foreign direct investment, which has become an essential element of the country's economic growth. Argentina's climate for foreign investment is among the most favorable in Latin America. 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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Major Publications

Estadística Minera de la República Argentina, Subsecretaría de Minería, Annual report.

Panorama Minero, Monthly magazine.

TABLE 1
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1993	1994	1995	1996	1997 e/
METALS						
Aluminum:						
Primary		172,900	175,000	185,500	183,900 r/	183,700
Secondary		14,400	14,400	10,000	15,800	15,800
Beryllium, beryl concentrate, gross weight		--	--	--	-- e/	--
Cadmium concentrate:						
Gross weight		80	68	82	127	74
Cd content		25	27 r/	43 r/	40 r/	45
Copper:						
Mine output, Cu content		--	--	--	-- e/	30,000 3/
Refined e/		15,000	16,000 r/	16,000	16,000	16,000 3/
Gold, mine output, Au content	kilograms	937	937	837	723	2,446 3/
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	3	80	--	--	--
Fe content	do.	1	28	--	--	--
Metal:						
Pig iron	do.	984	1,410 r/	1,568 r/	1,966 r/	2,066
Sponge iron (direct reduction)	do.	1,156	1,269 r/	1,328 r/	1,422 r/	1,501
Total	do.	2,140	2,679 r/	2,896 r/	3,308 r/	3,567 e/
Ferroalloys, electric-furnace:						
Ferromanganese		5,400	4,500	5,836	6,000 e/	6,000
Ferrosilicomanganese		18,500	29,358	27,344	28,000 e/	28,000
Ferrosilicon		19,579	11,669	14,017 r/	14,000 e/	14,000
Total		43,479	45,527	47,197 r/	48,000 e/	48,000
Steel, crude	thousand tons	2,886	3,314 r/	3,581 r/	4,075 r/	4,188
Semimanufactures 4/	do.	2,852 r/	3,249 r/	3,549 r/	3,600 r/ e/	3,650
Lead:						
Mine output, Pb content		11,826	9,981	10,521	11,272	13,400 3/
Metal:						
Smelter, primary e/		14,600	14,600	14,000	14,100	14,200
Refined:						
Primary		12,473	7,785	2,430	396	3,282 3/
Secondary		16,000	17,600	26,298	27,705	28,834 3/
Total		28,473	25,385	28,728	28,101	32,116 3/
Silver:						
Mine output, Ag content	kilograms	42,744	38,032	47,783 r/	50,399	54,413 3/
Metal, smelter e/	do.	108,000	108,000	110,000	140,000	145,000 3/
Tin: Metal, smelter e/		129 r/	100 e/	100 e/	100 e/	100
Uranium, mine output, U_3O_8 content	kilograms	148,000	94,000	68,000	27,000	--
Zinc:						
Mine output, Zn content		31,395	26,933	32,104	31,093	29,224 3/
Metal: Smelter:						
Primary		31,070	35,214	35,767	36,392	38,672 3/
Secondary e/		2,800	2,800	2,800	2,900	3,100 3/
Total		33,870	38,014	38,567	39,292	41,772 3/
INDUSTRIAL MINERALS						
Asbestos		309	260	300 e/	446	400
Barite		14,761	27,828	28,907	14,038	15,000
Boron materials, crude		146,349	215,021	244,933	342,210	270,000
Cement, hydraulic	thousand tons	5,647	6,276	5,447	5,117	6,858

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity 2/		1993	1994	1995	1996	1997 e/
INDUSTRIAL MINERALS--Continued						
Clays:						
Ball clay (plastic clay) e/	thousand tons	100	90	90	90	90
Bentonite		96,706	313,407	111,011	134,588	140,000
Foundry earth		96,709	119,179	120,000 e/	100,000 e/	100,000
Fuller's earth (decolorizing clay) e/		1,600	1,600	1,600	1,600	1,500
Kaolin		42,052	50,471	39,860	64,241	60,000
Refractory e/		32,000	30,000	--	--	--
Other 5/	thousand tons	2,700 e/	2,600 e/	--	--	--
Diatomite		3,096	6,260	4,938	8,647	5,000
Feldspar		55,764	42,516	37,095	72,539	40,000
Fluorspar		4,611	3,585	5,105	5,666	5,000
Gypsum, crude		519,181	549,759	590,055	633,121	600,000
Lithium, spodumene, amblygonite, gross weight e/		300	400	400	--	--
Mica:						
Sheet		720	720 e/	700 e/	297 e/	300
Waste and scrap		1,226	1,104	4,341	1,840	1,900
Nitrogen, N content of ammonia e/		72,000	73,000	78,700 r/	80,000 r/	106,900
Phosphates, Thomas slag e/ 6/		50	50	50	50	50
Pigments, mineral, natural, other e/		28	--	--	--	--
Pumice and related volcanic materials (perlite, pozzolan, toba, etc.)		98,631	131,661	74,941	81,283	80,000
Salt:						
Rock e/	thousand tons	1	3	1	--	--
Solar	do.	1,033	834	1,009	1,096	1,100
Total	do.	1,034	837	1,010	1,096	1,100
Sand and gravel:						
Sand:						
Construction	do.	16,246	14,368	15,726	16,628	16,600
Silica sand (glass sand)	do.	396	247	286	244	250
Gravel	do.	7,800	8,391	5,819	5,550	5,550
Soda ash e/		300	190	200	200	200
Stone:						
Basalt	thousand tons	1,112	1,653	1,975	1,133	1,130
Calcareous:						
Calcite, nonoptical		34,513	49,900	40,099	40,011	40,000
Calcium carbonate (chalk) e/		19,000	20,000	20,000	20,000	20,000
Dolomite		434,000	684,799	1,107,906	1,241,844	1,240,000
Limestone	thousand tons	10,740	11,970	11,540	12,315	12,300
Marble:						
Aragonite, broken		1,107	57	--	--	--
Onyx, in blocks and broken		1,701	68	122	--	--
Travertine, in blocks and broken		27,865	9,790	16,718	22,800	22,000
Unspecified, in blocks and broken		24,426	15,338	8,440	11,655	11,500
Flagstone		94,749	55,555	87,576	102,510	100,000
Granite:						
In blocks		87,337	88,215	125,547	113,456	110,000
Crushed	thousand tons	5,656	5,232	7,030	7,809	7,800
Quartz, crushed		101,399	69,605	95,121	130,951	130,000
Quartzite, crushed	thousand tons	490	618	1,841	899	900
Rhodochrosite		58	46	69	73	70
Gemstones (agate, amatist, apolo, turmalin, etc.)	kilograms	4,963	4,800	3,134	3,100	3,150
Sandstone e/		240	230	200	200	200
Serpentine, crushed		26,518	27,516	78,107	71,989	70,000
Shell, marl		247,928	238,037	869,650	883,990	880,000
Tuff, (tosca)	thousand tons	5,148	6,234	7,002	8,268	8,000
Strontium minerals, celestite		4,806	8,484	9,325	3,775	3,800
Sulfates, natural:						
Aluminum (alum)		29,240	131 r/	352	306	300
Magnesium (epsomite)		2,820	1,160	720	1,440	1,400
Sodium (mirabilite)		6,554	7,978	10,604	21,726	21,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity 2/		1993	1994	1995	1996	1997 e/
INDUSTRIAL MINERALS--Continued						
Talc and related materials:						
Pyrophyllite		1,962	1,996	4,189	2,180	2,100
Steatite e/		840	500	300	300	300
Talc		18,084	16,850	12,474	11,777	12,000
Total		20,886	19,346	16,963	14,257	14,400
Vermiculite		38	32	44	40 r/	45
Water, mineral-containing e/		140,000	130,000	135,000	135,000	130,000
Zeolite e/		90	90	90	90	90
MINERAL FUELS AND RELATED MATERIALS						
Asphalt and bitumen, natural (asphaltite)		160	121	662	3,476	3,500
Coal, bituminous	thousand tons	200	215	210 4/	200	200
Coke, all types, including breeze e/	do.	800	200	300 4/	200	200
Gas, natural:						
Gross	million cubic meters	26,621 r/	27,470 r/	30,472 r/	34,631 4/	35,000
Marketed 7/	do.	23,220 r/	24,021 r/	26,971 r/	31,140 4/	33,000
Natural gas liquids:						
Butane	thousand 42-gallon barrels	5,779 r/	7,317 r/	6,935 r/	7,265 4/	7,300
Propane	do.	6,996 r/	8,743 r/	8,395 r/	8,795 4/	8,800
Total	do.	12,775 r/	16,060 r/	15,330 r/	16,060 4/	16,100
Peat, agricultural (turba)		2,880 r/	2,574 r/	4,000 r/	2,692 4/	2,700
Petroleum:						
Crude	thousand 42-gallon barrels	216,810 r/	237,250 r/	260,975 r/	275,940 4/	305,000
Refinery products:						
Gasoline	do.	50,643 r/	51,666 r/	44,718 r/	44,895 r/	45,000
Kerosene	do.	2,760 r/	2,675 r/	2,480 r/	2,555 r/	2,600
Jet fuel	do.	6,431 r/	7,819 r/	7,499 r/	7,665 r/	7,700
Distillate fuel oil	do.	70,950 r/	65,631 r/	62,914 r/	62,780 r/	63,000
Lubricants e/	do.	1,825 r/	1,825 r/	1,825 r/	1,825 r/	1,800
Residual fuel oil	do.	24,880 r/	20,596 r/	18,025 r/	17,885 r/	18,000
Other	do.	9,180 r/	10,324 r/	10,515 r/	10,525 r/	10,600
Refinery fuel and losses	do.	26,338 r/	22,029 r/	28,473 r/	28,470 r/	28,500
Total	do.	193,007 r/	182,565 r/	176,449 r/	176,660 r/	177,200

e/ Estimated. r/ Revised.

1/ Table includes data available through September 1998.

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/ Reported figure.

4/ Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.

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/ Natural gas imported from Bolivia.

TABLE 2
ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(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 25%, and Rio Algom Ltd. of Canada 25%)	Bajo de La Alumbrera Mine, Belén Department, Catamarca Province	180 Cu, 20,000 Au.
Gold and silver	do.	Yacimientos Mineros de Agua de Dionisio (YMAD) (Government, 100%). Small mines (private, 100%)	Farallón Negro, Hualfín and Belén Catamarca Province Various in Jujuy Province	4,600 Au, 50,000 Ag. 5,000 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.
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%)	Near Rosario on the Paraná River, Santa Fe ProvinceProvince	35.