



# 2007 Minerals Yearbook

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## ARGENTINA

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# THE MINERAL INDUSTRY OF ARGENTINA

By Susan Wacaster

In 2007, Argentina produced 15% of the world's supply of boron, and 12% of the world's reported lithium (metal content), and was a significant producer of feldspar and strontium (from celestite). The country has resources of other minerals in addition to those that it produced at globally competitive levels, including supplies of precious and base metals, and industrial, precious, and semiprecious minerals. The Secretariat of Mining compiled a report of significant industry developments between 2003 and 2007. Beginning in about 2003, continually increasing levels of investment and exploration resulted in changes to the mining scenario in Argentina whereby precious metals, including gold, silver, and such associated base metals as copper, lead, tin, and zinc, have become more important in terms of project development and production (Kostick, 2008; Ober, 2008a, b; Potter, 2008; Secretaría de Minería de la Nación, 2008a).

In 2007, about 333,000 meters (m) of exploratory drilling was completed in Argentina compared with 170,000 m in 2003. Infrastructure developments were needed to facilitate exploration projects, as some important mineral deposits were located in remote areas of the country; consequently, the central Government, as part of its national mining plan, intended to help fund the construction of access roads needed to advance projects. About \$1.3 million was committed for the development of more than 60 mining access roads that would cover 2,650 kilometers (km) (Secretaría de Minería de la Nación, 2008a, b).

Argentina is divided into five mining regions, as follows: the Central region (which includes the Provinces of Buenos Aires, Córdoba, and Santiago del Estero), Northeast region (Provinces of Chaco, Corrientes, Entre Ríos, Formosa, Misiones, and Santa Fe), Northwest region (Provinces of Catamarca, Jujuy, Salta, and Catamarca), Nuevo Cuyo region (Provinces of La Rioja, Mendoza, San Juan, and San Luis), and Patagonia region (Provinces of Chubut, La Pampa, Neuquén, Río Negro, Santa Cruz, and Tierra del Fuego).

Mining in the Central region has been characterized by the production of amethyst, aquamarine, chromium, crushed stone, dolomite, feldspar, granite, gypsum, limestone, mica, quartzite, salt, and vermiculite. The Nuevo Cuyo region has produced bentonite, calcite, common salt, crushed stone, dolomite, feldspar, lapis lazuli, limestone, granite in blocks, gravel, gypsum, marble, mica, quartz, talc, and travertine. The Northeast region has produced amethyst, gypsum, and building stone. The Northwest region's principal mineral products have included borates, calcite, copper, corundum, crushed stone, flagstone, gold, granite, gravel, gypsum, lead, lithium salts, mica, peat, perlite, rhodochrosite, salt, silver, sodium sulfate, and zinc. The Patagonia region has produced barite, bentonite, celestite, coal, crushed stone, flagstone, fluorite, gold, gypsum, kaolin, limestone, salt, silver, and sodium sulfate. All regions have produced clays and sand for construction (Servicio Geológico Minero Argentino, 2002).

## Minerals in the National Economy

The Argentine Government has focused on mining in all areas of the country to contribute to the gross domestic product (GDP) as a whole, but especially in localities far from major industrial centers as a means to bolster employment and community development in those areas. In its summary of mining activities for 2003-07, the Mining Office reported that the Argentine mining industry had recovered from years of stagnation and that it was in a position to bring substantial economic growth to the country. Between 2003 and 2007, total investment in exploration, project development, and mineral production amounted to about \$1,800 million. In 2007, the mining sector employed 40,000 directly and 192,000 indirectly (Secretaría de Minería de la Nación, 2008a).

In a study that compared the growth rates of Argentine industries between 2004 and 2007, the nonmetallic mineral industry was one of three industries reported to have grown most quickly; however, the base metal and petroleum refinery industries were included among those that experienced the least growth; that is, growth of less than 5% annually. Argentina's economy grew by more than 8% in 2007 for the fifth straight year (Platts, 2007b; Ministerio de Economía y Producción, 2008).

## Government Policies and Programs

Argentina's Plan Minero Nacional [National Mining Plan] was introduced in 2004. It has been used as a framework to emphasize public education about and promotion of the mining industry, as well as a foundation for technical studies on such topics as the development of an environmentally sustainable mining industry, evaluation of markets for mineral products, new mineral applications, and the use of explosives. The plan also addresses programs for community involvement, technical assistance to small producers and artisanal miners, free participation for many mineral producers in national fairs, and participation of Government and industry officials in mining expositions (Secretaría de Minería de la Nación, 2008a, b).

To update information on the country's mineral development potential and facilitate an increase in exploration projects, Argentine officials continued a systematic evaluation of the mineral resources of the national territory in 2007. Geologic mapping helps provide the basis for development of infrastructure and mineral exploration, and medium-scale (1:250,000-scale) geologic maps continued to be compiled as the basis for evaluating existing infrastructure, geologic hazards, and metallogenic and industrial minerals. In 2007, the National Geological Mapping Program completed eight maps that covered 110,000 square kilometers (km<sup>2</sup>) at the 1:250,000-scale in the following Provinces: La Pampa, Mendoza, Neuquén, Río Negro, San Juan, Santa Cruz, and Tierra del Fuego. Five maps that were in progress would cover 70,000 km<sup>2</sup> in the Provinces

of Jujuy, Mendoza, Misiones, Neuquen, and Salta, and another 15 maps were in various stages of production. To facilitate exploration, two more-detailed 1:100,000-scale maps that covered areas of particular interest to mining were completed in 2007. Those maps covered 3,000 km<sup>2</sup> in the Provinces of Chubut and San Juan. Fourteen other detailed maps were still being compiled that would include territory in the Provinces of Catamarca, Chubut, Mendoza, San Juan, and Santa Cruz (Servicio Geológico Minero Argentino, 2008).

Metallogenic mineral studies have been conducted across an area of 120,000 km<sup>2</sup>. They included studies of copper in porphyry systems; evaluations of lead, silver, and zinc deposits; and modeling of platinum-group-metal deposits. Regional-scale studies contributed to the production of 1:250,000-scale maps of industrial mineral and gemstone deposits. The maps included deposits of clays in the Province of Rio Negro; gypsum, phosphates, and zeolites in the Provinces of Mendoza and San Luis; illite in the Province of Cordoba; industrial rock and mineral resources in the Province of La Pampa; and magnesite in San Juan Province (Servicio Geológico Minero Argentino, 2008).

Argentina is one of the main wine producing countries in the world. Wine production is located in some of the same Provinces as lucrative mining projects mainly in the central-western part of the country where Mendoza is the primary wine producing Province. In December 2006, amid concerns about water quality and environmental issues, the Provincial legislature of Mendoza suspended all open pit mining and stopped issuing exploration permits. One week later, Mendoza's Governor claimed that the legislation was unconstitutional and that the Provincial congress was attempting to enact laws under the jurisdiction of Argentina's National Congress. In May 2007, the lower house of the Mendoza Provincial congress overruled the Governor's veto. In June, the Mendoza Provincial government passed legislation (law No. 7,722) prohibiting the use of toxic chemicals, including cyanide, mercury, and sulfuric acid, in any mining activity in the Province. In December, several projects were delayed because of ambiguity and a few companies were reported to have filed suits challenging the law's constitutionality (Pereyra, 2006; Calypso Uranium Corp., 2007b; Coro Mining Corp, 2007; Nones, 2007).

In November 2007, the Government increased the export duties on gasoline and petroleum products. Crude oil sales were capped at \$42 per barrel for domestic sales. The objective was to increase the fiscal surplus to 4% of the GDP from 2.5% of the GDP and to fight inflation, which, in 2007, was running at either less than 10% according to Government estimates, or between 20% and 23% according to private estimates. Mining companies were affected by the increased inflation because wage increases were being sought by unions. Also in November, the central Government announced a plan to levy a 5% to 10% export tax on gross mineral sales, which would be applicable not only to new operations but also to companies that had previously been granted 30-year tax stability contracts. By January 2008, several mining companies reportedly had sued over the export duty claiming that it violated the 30-year tax stability certificates and the Mining Investment Act under which capital goods exports for mining projects were tax exempt (Alexander's Gas & Oil Connections, 2007b; Popper, 2007; AngloGold Ashanti Ltd., 2008).

At yearend, Barrick Gold Corp. of Canada's Pascua Lama gold and silver project was being routed through a lengthy permitting process in Argentina because of the site's location on the border with Chile. The Pascua Lama project was widely criticized owing to the company's plan to remove glaciers located on the surface of the deposits in Chile in order to construct an open pit mine. Chile's National Environmental Commission approved the project in early 2006 on the condition that the glaciers remained untouched and that a tunneled mine be developed; however, environmental groups reported partial destruction of several glaciers adjacent to the project (Burks, 2007; Barrick Gold Corp., 2008; Kosich, 2008a).

## Production

In terms of mine output of metals, cadmium production decreased to 111 metric tons (t) in 2007 from 122 t in 2006. Copper production remained nearly constant at 180,223 t compared with 180,144 t in 2006. Gold production decreased to 42,021 kilograms (kg) from 44,131 kg in 2006. Lead production increased to 17,045 t from 12,064 t in 2006. Silver production increased slightly to 255,567 t from 245,124 t in 2006. Zinc production decreased to 27,025 t from 29,808 t in 2006 (table 1; Instituto Nacional de Estadística y Censos Argentina, 2009a).

Production increased for most of the industrial minerals and mineral fuels and related materials for which 2007 production data were available. Mineral commodities for which production decreased included asbestos, bituminous coal, celestite, distillate fuel oil, flagstone, gemstones, liquefied petroleum gas, kerosene, jet fuel, lubricants, nitrogen (N content of ammonia), peat, petroleum, pumice, rhodocrosite, rhyolite, rock salt, sandstone, sodium sulfate, and tuff. Industrial minerals and mineral fuel commodities for which production increased significantly included asphalt (natural); barite; basalt; boron; calcareous stones, including calcite (nonoptical), dolomite, and limestone; cement (hydraulic); common salt; granite blocks; gravel; crushed quartz; quartzite; and serpentine (crushed) (table 1; Instituto Nacional de Estadística y Censos Argentina, 2009a, b).

## Structure of the Mineral Industry

In 2007, some of the active projects in Argentina included the following: (1) AngloGold Ashanti Ltd.'s Cerro Vanguardia gold and silver project (Patagonia region), which was a joint venture with the Province of Santa Cruz's state mining company Fomento Minero de Santa Cruz Sociedad del Estado (FOMICRUZ), and had been in production since 1998; (2) Barrick Gold Corp.'s Veladero gold and silver project (Nuevo Cuyo region), which had been in production since 1995; (3) Coeur d'Alene Mines Corp.'s Martha silver mine (Patagonia region), which had been in production since 2002; (4) Cia Mineras Aguilar, S.A.'s (Glencore International AG of Switzerland, 100%) Aguilar lead, silver, and zinc mine (Northwest region), which had been in production since 1939; and (5) Minera Alumbrera Ltd.'s Bajo de la Alumbrera copper, gold, and molybdenum project (Northwest region), which was one of the world's leading copper and gold producers and had been in production since 1997. In addition, Minera del

Altiplano S.A. (FMC Corp. of the United States) had produced lithium in the Northwest region from the Salar del Hombre Muerto since 1998. Rio Tinto Minerals plc had produced borates from the Tincalayu deposit in the Northwest region since the 1950s. Yacimientos Carbonífero Rio Turbio S.A. (YCRT) had produced coal from the Rio Turbio coal mine in the Patagonia region since 1958, and plans for a coal-fired powerplant at the site were being developed. State-owned (100%) Yacimientos Mineros de Agua de Dionisio's (YMAD) Farallón Negro gold and silver industrial complex in the northwest region had been in production since 1978 (Panorama Minero, 2009).

The San Jose (Huevos Verdes) gold and silver mine (Patagonia region), which began production in 2007, was a joint venture between Hoschild Mining plc (51%) and Minera Andes Inc. (49%). It was located in Santa Cruz Province and was associated geologically with the Deseado Massif. The Deseado Massif is a metallogenic region characterized by volcanic rocks with associated low-sulfidation epithermal mineralization that was the source not only for the San Jose project, but also for the Cerro Vanguardia and the Martha Mines. Pan American Silver Corp. of Canada's Manantial Espejo silver mine, which is located in the same area, was scheduled to come online for production in 2008. Several other projects connected to the Deseado Massif reached the feasibility stage by the end of 2007, and numerous exploration properties were ongoing at deposits for which the Deseado Massif was the host of mineralization (Busá, 2003; Panorama Minero, 2009).

## Mineral Trade

In 2007, international trade accounted to about 39% of Argentina's GDP, and total exports accounted for about 21% of the GDP. The mining sector accounted for 3% of the total foreign direct investment (FDI), and the petroleum sector accounted for 28% of the total FDI. Exports by FDI companies accounted for 75% of total exports. Spain was responsible for 51% of the FDI in the petroleum sector; the United States, 16%; the Netherlands, 7%; and Canada and France, 4% each; the remainder was split among other countries. Spain was responsible for 20% of the FDI in natural gas extraction; the United States, 16%; Denmark, 13%; the Netherlands and Italy, 9% each; and Belgium and Chile, 8% each; the remainder was from other countries (Banco Central de la República Argentina, 2007).

In 2007, Argentina's copper exports increased in value to \$1,358 million from \$1,335 million in 2006. Germany, Japan, and the Republic of Korea each received between 120,000 t and 170,000 t of the copper exports, and another 253,000 t went to other unspecified countries. The value of exported industrial minerals and some of their products was \$2,816 million compared with \$2,484 million in 2006. Exports of gemstones, precious metals, and some other unspecified manufactured products and monies were valued at \$579 million compared with \$560 million in 2006.

Crude petroleum exports were valued at \$1,300 million compared with \$2,400 million in 2006. The United States imported 22 million barrels (Mbbbl) valued at \$708 million, and other countries received 11 Mbbbl valued at \$588 million. Gasoline (excluding aviation fuel) exports were valued at

\$1,037 million, of which the United States received 4 Mbbbl valued at \$310 million; Mexico received 2 Mbbbl valued at \$188 million; Nigeria received 2 Mbbbl valued at \$172 million; and other countries received 5 Mbbbl valued at \$367 million. Natural gas exports totaled 82 million cubic meters valued at \$455 million and Chile received 74 million cubic meters valued at \$395 million. The value of exported petroleum gas and gaseous hydrocarbon (probably propane and butane) was \$1,476 million compared with \$1,684 million in 2006. Exports of other combustibles were valued at \$127 million compared with \$117 million in 2006 (Banco Central de la República Argentina, 2007; Instituto Nacional de Estadística y Censos Argentina, 2008; Ministerio de Economía y Producción, 2008).

Imports of natural gas were valued at \$139 million. A quantity of diesel fuel valued at \$1,123 million was imported primarily from Brazil and the United States. Fuel oil valued at \$386 million was imported from The Bahamas and other countries. More than 2.3 million metric tons (Mt) of iron ore and 3 Mt of iron ore sinter, which had a combined value of more than \$473 million, was imported almost entirely from Brazil (Instituto Nacional de Estadística y Censos Argentina, 2008; Ministerio de Economía y Producción, 2008).

## Commodity Review

### Metals

**Aluminum.**—In June 2007, Aluar Aluminio Argentino S.A.I.C. began expansion of its primary aluminum smelter located in Chubut Province. The company reported that the expansion project, in which the company would invest \$950 million, was among the most significant private endeavors ever undertaken in the country. Stage I of the enlargement was expected to increase the production capacity by 137,000 metric tons per year (t/yr) to reach an annual production capacity of 410,000 t. Stage II of the project was expected to expand production by another 105,000 t/yr and to increase exports by at least \$130 million. Project completion was projected for the third quarter of 2009 (Aluar Aluminio Argentino, 2009).

**Copper.**—Copper mine output in 2007 increased slightly to 180,223 t from 180,144 t in 2006. Canada-based Yamana Gold Inc.'s Agua Rica project, which was a copper, gold, and molybdenum porphyry deposit located in Catamarca Province, was estimated to contain nearly 800 Mt of total proven and probable reserves grading 0.49% copper. The property was located 34 km from Minera Alumbrera Ltd.'s open pit copper and gold mine. Xstrata plc's (100%) El Pachon copper and molybdenum project was at the exploration and prefeasibility stage. The development project was located 5 km from the Chilean border in the Nuevo Cuyo region. Xstrata gained the property through its 2006 takeover of Falconbridge Ltd. (Yamana Gold Inc., 2008, p. 29; Panorama Minero, 2009; Xstrata plc, 2009a, b).

**Gold.**—Gold production decreased slightly to 42,021 kilograms (kg) in 2007 from 44,131 kg in 2006. AngloGold Ashanti's Cerro Vanguardia gold mine produced 5,783 kg of gold in 2007, which was a decrease from the 6,095 kg produced in 2006 and which accounted for 4% of the company's total



production for the year. Barrick Gold's Veladero gold mine produced 13,400 kg of gold. The Veladero Mine is located in San Juan Province, 10 km to the south of the company's Pascua Lama property. The Pascua Lama gold and silver project had reached the feasibility stage. The mine had proven and probable gold reserves of more than 510,000 kg of contained gold, 21,000 t of contained silver, and more than 300 t of contained copper (AngloGold Ashanti Ltd., 2008; Barrick Gold Corp., 2008, 2009; Panorama Minero, 2009).

Yamana Gold gained a 12.5% share in the Bajo de la Alumbrera gold and copper mine after its 2007 acquisition of Northern Orion Resources Inc. Minera Alumbrera was owned by Xstrata (50%) and Goldcorp Inc. (37.5%). In January 2008, Rio Tinto Ltd. bought into the Taca Taca copper and gold porphyry deposit owned by Canada's Global Copper Corp. The property had been explored previously by several mining companies but had never been developed. Rio Tinto was to earn a 75% interest in Taca Taca after paying Global Copper \$80 million during 3 years, completing 25,000 m of drilling, and taking responsibility for the first \$120 million of development funding (Reuters, 2008; Yamana Gold Inc., 2008, p. 22).

**Iron and Steel.**—Minera Sierra Grande S.A. (100%) expected to begin iron ore production and shipments in 2009 from its Sierra Grande deposit in the Patagonia region.

**Silver.**—In 2007, AngloGold Ashanti's Cerro Vanguardia gold mine in the Province of Santa Cruz produced about 11,900 kg of silver. Silver Standard Resources, Inc. of Canada (100%) reported proven and probable silver reserves for the Pirquitas Mine of 21 Mt at an average grade of 198 grams per metric ton silver. Commissioning of the silver, tin, and zinc mine was scheduled for the fourth quarter of 2008 with projected average annual production of greater than 309,000 kg of silver, greater than 2,500 t of tin, and greater than 6,500 t of zinc. Aquiline Resources Inc. was conducting a prefeasibility study of its Navidad Mine, which was reportedly one of the world's largest undeveloped silver deposits with measured and indicated resources of almost 13 million kilograms of silver (Silver Standard Resources Inc., 2008; Panorama Minero, 2009).

### **Industrial Minerals**

**Boron.**—Salt mines are an important source of borate (mainly ulexite) in South America, and all the known Argentine borate deposits were located in northwestern Argentina. South American borate production was dominated by the Tincalayu open pit borax mine, which was operated by Borax Argentina, S.A. (a member of the Rio Tinto Minerals plc group). The Tincalayu complex was South America's leading borate mining operation and its only source of natural sodium borates. The deposit was located in Salta Province near the Salar del Hombre Muerto. The pit measured 1,500-m wide by 500-m long by 100-m deep. The main types of borates mined there were colemanite, hydroboracite, kernite, tincal, and ulexite. The refinery in Salta produced borax, boric acid, and anhydrous and mineral products (Carpenter and Kistler, 2006; Borax Argentina, S.A., 2009).

Borax Argentina also mined colemanite, hydroboracite, and ulexite at Sijes close to the Salar Pastos Grandes (in Bolivia), and ulexite from several salt mines in the Provinces of Jujuy

and Salta. Borax Argentina's processing plant and boric acid facility were located at Camp Quijano near the city of Salta. Procesadora de Boratos, Argentina, S.A. operated a borax and ulexite deposit at Loma Blanca near Coranzuli in Jujuy Province and its plant was located at Palpala near the city of San Salvador de Jujuy. In 2007, Minera Santa Rita, S.R.L. discovered a new ulexite deposit at its property in the Salar del Hombre Muerto. The company also had reserves and mines in the Salars of Cauchari, Centenario, Pozuelos, and Ratones (Carpenter and Kistler, 2006; Borax Argentina, S.A., 2009; Minera Santa Rita, S.R.L., 2009).

**Cement.**—Cement production in Argentina reached a new high of 9.6 Mt in 2007, which was a 7.5% increase compared with that of 2006, but which represented a relatively smaller production increase compared with all other years since 2003. Nearly 9.5 Mt of cement was distributed to the domestic market, which was an 8% increase compared with the amount distributed to the domestic market in 2006. Cement exports decreased by 24% to 114,000 t, of which just 2 t was reported as clinker, compared with 150,000 t exported in 2006, of which 36,000 t was clinker. Cement exports had decreased since 2004. Argentina's total cement consumption in 2007 was 9.6 Mt, and consumption was reported in such municipalities as Gran Buenos Aires [Greater Buenos Aires] (2.3 Mt), Cordoba (1 Mt), Tucuman (932,903 t), Santa Fe (898,380 t), and Mendoza (481,839 t), and in the Ciudad Autónoma de Buenos Aires [Autonomous City of Buenos Aires] (425,590 t) (Asociación de Fabricantes de Cemento Pórtland, 2008).

**Potash.**—Companhia Vale do Rio Doce (100%) had reached the feasibility stage for its Potasio Río Colorado potash deposit in the Nuevo Cuyo region.

### **Mineral Fuels and Related Materials**

**Natural Gas.**—In 2007, total production of natural gas reached almost 51,000 million cubic meters. Gas-producing basins were divided into five regions, which, with their respective fields, included the Austral region (Estado Nacional, Santa Cruz Sur offshore, Santa Cruz Sur onshore, Tierra del Fuego offshore, and Tierra del Fuego onshore), Cuyana region (North Mendoza field), Golfo San Jorge region (Chubut and North Santa Cruz fields), Neuquina region (La Pampa, Mendoza Sur, Neuquen, Rio Negro fields), and the Northwest region (Formosa, Jujuy, and Salta fields). In 2007, the Neuquina basin held the largest natural gas reserves in the country with 194 million cubic meters, and the country as a whole reported 442 million cubic meters of reserves. In January, Argentina's Government introduced a surcharge on major natural gas consumers to finance a \$2.4 billion project for expanding the capacity of the national gas pipeline system by 17% through 2008. The charge increased gas rates by about 30% for factories and power and petrochemical producers. The industrial and power sectors accounted for two-thirds of Argentina's average demand of 125 million cubic meters per day. Homes, small retailers, and 1.5 million motorists accounted for 34% of gas demand and were not directly affected by the surcharge. In June, Argentina and Bolivia agreed to construct a pipeline, the Northeast Pipeline, to deliver natural gas supplies from

Bolivia to five Provinces in Argentina. Bolivia had the second largest natural gas reserves in Latin America after Venezuela. Argentina, which produces substantial quantities of natural gas, was having difficulty meeting both domestic demand and a contractual agreement to export natural gas to Chile. The two countries had also been in negotiations to construct a petrochemical plant in Bolivian territory. The facility was expected to begin operations in 2009 (Alexander's Gas & Oil Connections, 2007a; Platts, 2007a; Instituto Nacional de Estadística y Censos Argentina, 2009b, c).

**Petroleum.**—In 2007, Argentina produced almost 224 Mbbbl of crude petroleum. The petroleum producing basins with their respective fields were in the same locations as the natural gas basins. In 2007, the Neuquina basin held the largest reserves with 1,566 Mbbbl, whereas the country as a whole had 2,616 Mbbbl. Forty-eight companies produced crude oil in 2007. Spain's Repsol YPF S.A. was the primary producer with 88 Mbbbl, or 38% of the country's total; Pan American Energy LLC Sucursal Argentina produced 38 Mbbbl, or 16% of the total; and Chevron Argentina S.R.L. produced 20 Mbbbl, or 8% of the total. Three other companies produced between 1 Mbbbl and 20 Mbbbl each, and all other companies produced anywhere between 1,000 barrels and 1 Mbbbl each (Instituto Nacional de Estadística y Censos Argentina, 2009a, b; Secretaria de Energia de la Nacion, 2009).

**Uranium.**—The World Bank loaned \$30 million to Argentina's Atomic Energy Commission (CNEA) for remediation of closed uranium mines. Abandoned uranium mines and milling sites were inventoried to assess low-level radioactive waste. There were no operating uranium mines in Argentina in 2007; however, exploration resulted in new discoveries. Wealth Minerals Ltd. discovered a new uranium district at its Diamante-Los Patos property in the Provinces of Catamarca and Salta. Mineralization in four discovery zones was associated with the Cerro Galan Caldera complex, which was the second largest caldera in the world (60 km in diameter). The mineralization is hosted by rhyolitic to dacitic ignimbrites and occurs as cement in porous rock units and in breccia and fault fractures (Wealth Minerals Ltd., 2007; Kosich, 2008b).

Calypso Uranium, with its subsidiary Energia Mineral Inc. S.A., controlled 4,470 km<sup>2</sup> of uranium mineral concessions located in the Provinces of Chubut, Mendoza, and Neuquen. Several properties included resources previously confirmed by the CNEA. In Mendoza, those properties included past uranium producers in the Pampa Amarilla district and a property in the Sierra Pintada uranium producing district. In Neuquen Province, concessions included the Norte Block Uranium district, which hosted copper, uranium, and vanadium mineralization, and the Central Block uranium district. In the San Jorge Basin in Chubut Province, 12,000 t of resources was located at the Cerro Solo deposit. Development of at least one of the properties in Mendoza was interrupted because of the Province's ban on the use of toxic substances (Calypso Uranium Corp., 2007a).

## Outlook

The Secretariat of Mining in Argentina has been involved at all levels of community and Government to develop the

country's mining industry to its full potential. Mining activity, including projects, jobs, production, and exports was projected to continue to grow at historical levels of investment; all within an environmentally and socially sustainable framework. By 2015, the country expects to have 18 major projects in production, with increased production expected for most sectors of the industry, which would provide 87,250 direct and 316,000 indirect jobs.

At the end of 2007, ambiguity regarding export tax liabilities and environmental regulations was cause for concern among some companies because the majority of companies that export mineral commodities were largely private foreign investment companies. The export tax increase was expected to promote a decline in petroleum production and, therefore, in the production of refinery products.

The new President of Argentina took office at the end of 2007, and it was uncertain how executive changes would affect regulatory issues. The fact remains that because of its geology, location, and size, Argentina has abundant mineral resources, and the central Government is likely to continue implementing its plan to develop the mineral industry during the next 50 years. It appears likely, therefore, that disputes over regulations and tax liabilities will be resolved to allow for the development and progress of all major projects; however, the often volatile Argentinean economy could likely affect the growth of the mining industry in the near term.

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TABLE 1  
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity	2003	2004	2005	2006	2007	
<b>METALS</b>						
<b>Aluminum:</b>						
Primary	272,369	272,048	270,714	272,942	273,000 <sup>e</sup>	
Secondary <sup>c</sup>	16,000	16,000	16,000	16,000	16,000	
Antimony, refined, secondary	1,900 <sup>e</sup>	1,967	2,200	2,208	2,726	
<b>Cadmium:</b>						
Mine output, Cd content	126	111	124	122	111	
Refined	25	39	3	6	35	
<b>Copper:</b>						
Mine output, Cu content	199,020	177,143	187,317	180,144	180,223	
Refined, secondary <sup>c</sup>	16,000	16,000	16,000	16,000	16,000	
Gold, mine output, Au content	kilograms	29,749 <sup>r</sup>	28,466	27,904	44,131	42,021
<b>Iron and steel:</b>						
<b>Metal:</b>						
Pig iron	thousand metric tons	2,402	2,392	2,644	2,481	2,500 <sup>e</sup>
Sponge iron (direct reduction)	do.	1,736	1,755	1,823	1,947	200 <sup>e</sup>
Total	do.	4,138	4,147	4,467	4,428	2,700 <sup>e</sup>
<b>Ferrous alloys, electric furnace:<sup>c</sup></b>						
Ferrosilicomanganese		5,000	24,000	25,000 <sup>2</sup>	25,000	25,000
Ferrosilicon		2,700	10,000	10,000 <sup>2</sup>	10,000	10,000
Total		7,700	34,000	35,000 <sup>2</sup>	35,000	35,000
Steel, crude	thousand metric tons	5,033	5,133	5,386	5,533	5,600 <sup>e</sup>
Semimanufactures <sup>3</sup>	do.	4,680	4,803	4,932	5,318	5,400 <sup>e</sup>
<b>Lead:</b>						
Mine output, Pb content		12,079	9,551	10,683	12,064 <sup>r</sup>	17,045 <sup>4</sup>
Smelter, primary		12,100 <sup>e</sup>	11,000 <sup>e</sup>	10,607	12,064	11,000 <sup>e</sup>
<b>Refined:</b>						
Primary		11,011	11,111	10,607	12,064	11,568
Secondary <sup>c</sup>		30,300	48,000	35,000	37,000	49,000
Total <sup>c</sup>		41,300 <sup>r</sup>	59,100 <sup>r</sup>	45,600 <sup>r</sup>	49,100 <sup>r</sup>	60,600
Manganese		--	--	1,800	--	--
Silver, mine output, Ag content	kilograms	133,917	172,387	263,766	245,124 <sup>r</sup>	255,567
Tin, refined, secondary <sup>c</sup>		100	120	120	120	120
<b>Zinc:</b>						
Mine output, Zn content		29,839	27,220	30,227 <sup>r</sup>	29,808 <sup>r</sup>	27,025
<b>Metal, smelter:</b>						
Primary		39,221	35,461 <sup>r</sup>	37,460 <sup>r</sup>	42,584	42,876
Secondary		3,139	2,837	2,997	3,407	3,430
Total		42,360	38,298 <sup>r</sup>	40,457 <sup>r</sup>	45,991	46,306
<b>INDUSTRIAL MINERALS</b>						
Asbestos		166	267	260	299	282
Barite		6,934	2,762	3,355	6,276	37,979 <sup>4</sup>
Boron materials, crude		512,167	821,031	632,792	533,535	669,578
Cement, hydraulic	thousand metric tons	5,217	6,254	7,595	8,929	9,602
<b>Clays:</b>						
Bentonite		146,846 <sup>r</sup>	163,028	247,101	246,165 <sup>r</sup>	250,260
Common		1,682,158	2,348,895	6,373,687 <sup>r</sup>	6,832,211 <sup>r</sup>	8,429,889 <sup>4</sup>
Kaolin		19,219	39,072	54,903	49,619	69,354 <sup>4</sup>
Diatomite		35,518	26,912	34,045	38,543	49,604
Feldspar		90,857	125,684	151,307	170,728	291,562 <sup>4</sup>
Fluorspar		5,422	6,437	7,502	8,278	9,735
Gypsum, crude		489,804	836,298	1,073,286	1,202,812	1,226,530
Lime <sup>c</sup>		1,500,000	1,500,000	1,500,000	1,800,000	1,800,000
<b>Lithium:<sup>5</sup></b>						
Carbonate		2,846 <sup>r</sup>	4,961 <sup>r</sup>	7,288 <sup>r</sup>	8,228 <sup>r</sup>	8,863
Chloride		4,707 <sup>r</sup>	6,315 <sup>r</sup>	8,416 <sup>r</sup>	8,336 <sup>r</sup>	8,843

See footnotes at end of table.



TABLE 1—Continued  
 ARGENTINA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity	2003	2004	2005	2006	2007
<b>INDUSTRIAL MINERALS—Continued</b>					
Mica	1,894	2,518	4,101	6,223	10,171
Nitrogen, N content of ammonia	726,431	705,318	654,786	726,969	726,000
Peat, agricultural (turba)	12,728 <sup>r</sup>	9,110	11,452	15,119	13,665
Perlite	21,480	21,193	21,991	25,146	35,838
Phosphate rock:					
Gross weight	--	70	225	65	--
P <sub>2</sub> O <sub>5</sub>	--	21	67	20	--
Pozzolan	930	250	2,001	3,994	4,207
Pumice	3,531	9,188	15,361	17,665	16,200
Salt, common	1,667,851	1,371,969	1,845,833	1,917,656	2,357,674
Salt, rock	22	177	254	242	179
Sand and gravel:					
Sand:					
Construction	11,978,789	17,975,085	20,194,111 <sup>r</sup>	21,143,480 <sup>r</sup>	28,381,250
Silica sand (glass sand)	300,707	473,207	461,242	446,240	456,171
Gravel	6,567,223	10,752,425	10,078,475 <sup>r</sup>	10,832,689	18,517,249
Stone:					
Basalt	334,542	615,412	633,215	542,475	841,503
Calcareous:					
Calcite, nonoptical	91,270	104,960	49,700	57,800	131,357 <sup>4</sup>
Dolomite, including crushed	318,913	437,290	346,537	392,681	670,411 <sup>4</sup>
Limestone	8,148,645	10,644,948	12,267,049	12,993,352	16,152,271 <sup>4</sup>
Crushed, unidentified	4,463,492	7,935,563	11,533,468	12,269,384	22,586,494 <sup>4</sup>
Marble, onyx, travertine	44,411	49,739	148,192	160,535	164,021
Flagstone	383,097 <sup>r</sup>	531,769 <sup>r</sup>	193,308 <sup>r</sup>	550,529 <sup>r</sup>	268,662 <sup>4</sup>
Granite, in blocks	48,156	54,950	62,215	71,395	100,523
Quartz, crushed	99,097	88,334	170,668	206,282	287,138
Quartzite, crushed	284,503	512,400	784,900	854,560	922,000
Rhyolite	7,475	8,596	--	26,544	14,661
Rhodochrosite kilograms	23,915 <sup>r</sup>	109,476 <sup>r</sup>	118,200 <sup>r</sup>	78,832 <sup>r</sup>	50,593
Gemstones (agate, amethyst, and so forth) do.	43,288	50,599	81,579 <sup>r</sup>	54,505 <sup>r</sup>	13,745 <sup>4</sup>
Sandstone	3,612	25,980	69,001	22,452	15,000 <sup>4</sup>
Serpentine, crushed	950	1,200	1,500	1,725	184,480 <sup>4</sup>
Shell, marl	195,014	263,269	261,183	276,233	297,000
Tuff (toba) thousand metric tons	50,203 <sup>r</sup>	18,576 <sup>r</sup>	77,788 <sup>r</sup>	108,567 <sup>r</sup>	97,108
Strontium minerals, celestite	4,300	6,727	7,233	19,822	4,909 <sup>4</sup>
Sulfates, natural:					
Magnesium (epsomite)	7,383	8,490	1,440	1,440	1,730
Sodium (mirabilite)	10,787	12,405	51,190	43,854	27,957 <sup>4</sup>
Talc and related materials:					
Pyrophyllite	4,525	12,594	8,470	9,340	9,880
Steatite <sup>c</sup>	300	300	300	300	300
Talc	1,699	7,620	12,603	13,773	14,956
Total	6,524	20,514	21,373	23,413	25,136
Vermiculite	1,124	1,293	1,403	1,585	1,726
Zeolites	489,805	836,298	1,073,286	1,202,812	1,226,530
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Asphalt and bitumen:					
Natural (asphaltite)	--	521	923	1,475	6,758 <sup>4</sup>
Byproduct of refinery	479,389 <sup>r</sup>	645,619 <sup>r</sup>	675,102 <sup>r</sup>	658,389 <sup>r</sup>	680,821
Coal, bituminous thousand metric tons	118	120	320	295	220
Coke, all types, including breeze do.	1,621	1,546	1,496	1,191	1,200 <sup>e</sup>

See footnotes at end of table.

TABLE 1—Continued  
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity	2003	2004	2005	2006	2007	
MINERAL FUELS AND RELATED MATERIALS—Continued						
Gas, natural:						
Gross	million cubic meters	48,876 <sup>r</sup>	50,254 <sup>r</sup>	48,738 <sup>r</sup>	51,665 <sup>r</sup>	50,891
Marketed <sup>c</sup>	do.	41,119 <sup>2</sup>	45,000	41,000	41,000	41,000
Natural gas liquids <sup>c</sup>	thousand 42-gallon barrels	18,000	18,000	18,000	18,000	18,000
Petroleum:						
Crude	do.	268,915 <sup>r</sup>	252,536 <sup>r</sup>	241,044 <sup>r</sup>	240,579 <sup>r</sup>	233,824
Refinery products: <sup>6</sup>						
Liquefied petroleum gas	do.	13,236	12,652	11,624	11,464	11,027
Motor gasoline	do.	55,378	53,828	53,642	54,319	54,300 <sup>e</sup>
Aviation gasoline	do.	(7)	--	22	--	--
Jet fuel	do.	8,949	9,560	9,980	9,385	10,111
Kerosene	do.	218	231	191	178	167
Distillate fuel oil	do.	1,313 <sup>r</sup>	1,416 <sup>r</sup>	963 <sup>r</sup>	819 <sup>r</sup>	764
Residual fuel oil	do.	12,693 <sup>r</sup>	15,478 <sup>r</sup>	18,227 <sup>r</sup>	22,498 <sup>r</sup>	28,268
Lubricants	do.	2,945 <sup>r</sup>	2,665 <sup>r</sup>	2,443 <sup>r</sup>	2,435 <sup>r</sup>	2,150
Other	do.	28,842	30,087	30,170	34,823	34,900 <sup>e</sup>
Total	do.	123,574 <sup>r</sup>	125,917 <sup>r</sup>	127,262 <sup>r</sup>	135,921 <sup>r</sup>	141,687

<sup>c</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>r</sup>Revised. Do., do. Ditto. -- Zero.

<sup>1</sup>Table includes data available through March 31, 2009.

<sup>2</sup>Reported figure.

<sup>3</sup>Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.

<sup>4</sup>A reported figure that shows dramatic increase or decrease compared with the previous year.

<sup>5</sup>New information was available from Argentine sources that prompted major revisions in how lithium production is reported.

<sup>6</sup>Excludes asphalt and coke production, which are reported separately.

<sup>7</sup>Less than 1/2 unit.

TABLE 2  
ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity <sup>1</sup>
Aluminum	Aluar Aluminio Argentino S.A.I.C. (private, 100%)	Abasto, Buenos Aires Province, and Puerto Madryn, Chubut Province	275.
Boron	Borax Argentina S.A. (Rio Tinto Borax, 100%)	El Porvenir Mine and plant, Jujuy Province; Sije and Tincalayu Mines and plants, and Campo Quijano refinery, Salta Province	615.
Do.	Procesadora de Boratos Argentinos S.A. (Ferro Corp. and JEM Resources)	Loma Blanca, Jujuy Province, and plant at Palpala, Jujuy Province	36.
Do.	Ulex S.A. (private, 100%)	Pastos Grandes, Salta Province	2.
Do.	Norquímica S.A.	Salta Province	5.
Cement	Cementos Loma Negra C.I.A.S.A. (private, 100%)	Buenos Aires, Cordoba, Corrientes, Salta, Salta Juan, Mendoza, and Jujuy Provinces	6,000.
Do.	Cementos Avellaneda, S.A. (Corporación Uniland S.A. and C. Molins International S.A.)	La Caldera plant, San Luis Province, and Olavarria plant, Buenos Aires Province	2,800, 220 lime.
Do.	Juan Minetti S.A. (Holcim Ltd., 100%)	Cordoba, Jujuy, and Mendoza Provinces	1,700.

See footnotes at end of table.

TABLE 2—Continued  
 ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity <sup>1</sup>
Coal		Yacimientos Carbonífero Río Turbio S.A. (private, 100%)	Río Turbio, Santa Cruz Province	210.
Copper and gold <sup>2</sup>		Minera Alumbreira Ltd. (Xstrata plc, 50%; Goldcorp Inc., 37.5%; Yamana Gold Inc., 12.5%)	Bajo de la Alumbreira Mine, Catamarca Province	160 Cu, 13,000 Au.
Gold and silver	kilograms	Cerro Vanguardia S.A. (AngloGold Ashanti Ltd., 92.5%, and Government of Santa Cruz Province, 7.5%)	Cerro Vanguardia Mine, Santa Cruz Province	100,000 Ag, 10,000 Au.
Do.	do.	Minera Argentina Gold (Barrick Gold Corp., 100%)	Veladero Mine, San Juan Province	21,000 Au, Ag, NA.
Do.	do.	Yacimientos Mineros de Agua de Dionisio (Government, 100%)	Farallon Negro, Hualfin, and Belen, Catamarca Province	4,600 Au, 50,000 Ag.
Do.	do.	Small mines (private, 100%)	Jujuy Province	5,000 Ag.
Iron and steel		Siderar S.A.I.C. (Ternium S.A., 60.93%)	San Nicolas, Buenos Aires Province	2,600 steel, 1,100 pig iron.
Do.		Acindar S.A. (AcelorMittal Group, 65%)	Plant Nos. 1 and 3, Buenos Aires Province; and Plant No. 2, near Rio Parana, Santa Fe Province	1,350 steel, 1,000 DRI.
Do.		Siderca S.A.I.C. (Techint Group)	Buenos Aires Province	900 steel, 670 DRI.
Lead and silver, refinery <sup>3</sup>		Cía. Minera Aguilar S.A. (Glencore International AG, 100%)	Refineria Aguilar, Palpala Industrial Park, Jujuy Province	18,000 Ag. 15 Pb.
Lead, silver, and zinc <sup>3</sup>		do.	Estacion Tres Cruces, El Aguilar, Jujuy Province	49,800 Ag, 24 Pb.
Lithium	metric tons	Minera del Altiplano S.A. (FMC Corp.)	Salar del Hombre Muerto, Salta Province	7,260 chloride, 11,350 carbonate.
Natural gas	million cubic meters	Repsol YPF S.A.	Neuquen, Rio Negro, Salta, Santa Cruz, and Tierra del Fuego Provinces	18,000.
Petroleum	million 42-gallon barrels	do.	Chubut, Formosa, Jujuy, La Pampa, Mendoza, Neuquen, Rio Negro, Salta, Santa Cruz, and Tierra del Fuego Provinces	366.
Uranium, ore <sup>4</sup>		Empresa Nuclear Mendoza (subsidiary Nucleoeléctrica Argentina S.A.)	Sierra Pintada, San Rafael, Mendoza Province	160.
Zinc, refinery		Aguilar AR Zinc Group (Glencore International AG, 100%)	Rosario, Santa Fe Province	44.

NA Not available.

<sup>1</sup>Abbreviations used in this table for commodities include the following: Ag—silver; Au—gold; Cu—copper; DRI—direct-reduced iron; and Pb—lead.

<sup>2</sup>Gold data reported in kilograms.

<sup>3</sup>Silver data reported in kilograms.

<sup>4</sup>Inactive.