



2013 Minerals Yearbook

ARGENTINA

THE MINERAL INDUSTRY OF ARGENTINA

By Susan Wacaster

In 2013, Argentina produced and traded such metals as cadmium, copper, gold, lead, molybdenum, silver, and zinc; such energy minerals as natural gas, crude petroleum, and uranium; and a wide variety of industrial minerals, including lithium. Copper, gold, silver, and zinc, which are associated primarily with epithermal deposits, remained the most valuable mineral commodities produced in Argentina. The country's mineral endowment was relatively unexploited, and the deteriorating economy contributed to decreases in mining investment and exploratory drilling. In 2013, Argentina's exploration budget decreased to \$292 million, or by 43% compared with that of 2012, which was the lowest level since 2009; the country's exploration budget accounted for 2% of the world's exploration budget (SNL Metals Economics Group, 2013, p. 40).

Argentina's total (cumulative) external debt as a percentage of its gross domestic product (GDP) averaged 40.7% in the 1990s, 74.5% in the 2000s (when it ranged between a high average of 153.6% in 2002—a time of great financial crisis—and a low average of 37.7% in 2009), and 4.9%, 31.4%, and 29.6% in 2010, 2011, and 2012, respectively. During the past 3 years, the country's foreign exchange reserves, which had been generated primarily by exports of grains, had been depleted; in 2013, they decreased by 20% to \$34.4 billion (the lowest level since 2007). By October 2013, Argentina was dealing with another currency devaluation and the possibility of sovereign debt default related to the country's recession of 1999–2002 and the resultant economic crisis of late 2001 and 2002. In 2005 and 2010, debt restructuring allowed Argentina to repay all its obligations to the International Monetary Fund, and public debt had decreased again to 45% of the GDP. At yearend 2013, a small group of the bondholders that had invested in Argentina's distressed securities in the early 2000s (about one-half of which were issued post-crisis through private equity funds that purchased the debt at a discount to profit from repayment) refused the terms of the debt swap and brought a legal suit against the Government of Argentina in U.S. courts (Blackman and Mukhi, 2010; Levine, 2013; Nahón, 2013; Comisión Económica para América Latina y el Caribe, 2014).

Minerals in the National Economy

The value of production of goods (including those from the agriculture, forestry, and livestock; construction; electricity, gas, and water; fishing; manufacturing; and mining and quarrying sectors) accounted for 34.1% of Argentina's nominal GDP in 2013 compared with a revised 34.4% in 2012. The value of the mining and quarrying sector accounted for 2.8% of Argentina's total GDP compared with 3.0% in 2012, and the value of the production of goods accounted for 8.6% of the total GDP compared with 3.0% in 2012 (Instituto Nacional de Estadística y Censos, 2014b).

Historically, the mineral industry in Argentina began to receive significant investment as a result of legislation passed in the early 1990s, and the value contributed to the GDP from mining and quarrying had increased annually since at least 1993, except for in the recession years of 1997 and 1998, in 2001, and in 2007 (a modest decrease). Despite the economic crisis in 2001 and 2002, the value of the mineral industry decreased by only 6% in 2001 compared with that of 2000 as inward foreign direct investment (FDI) to the sector continued to increase. In 2002, the value of the mineral industry increased by 181% compared with that of 2001. That increase was owing in part to decreased operational costs as a result of the country's currency crisis. A subsequent mineral commodity price boom in the mid-2000s further supported economic stability in the mineral industry. In 2008 and 2009, when much of the world was experiencing fallout from a global financial downturn, the value of Argentina's mineral industry as a percentage of the GDP again remained constant or increased, and it continued to do so through 2012 (Comisión Económica para América Latina y el Caribe, 2014; Instituto Nacional de Estadística y Censos, 2014b).

In 2013, private analysts estimated that inflation had increased to at least 25% per year for several consecutive years (as opposed to the Argentine Government's reported rate of between 10% and 11%) as the Central Bank had maintained low interest rates and increased the monetary supply. The Government set limits on repatriations of profits out of Argentina. Mining companies had to exchange U.S. dollars earned from exports into pesos on Argentina's regulated currency market at a rate that was 40% less than the unofficial rate, yet many of the services that those same companies used were priced at the unofficial rate (Levine, 2013).

Government Policies and Programs

Argentina's Dirección Nacional Minería [National Mining Directorate (DNM)] oversees the administration, development, and promotion of mining and mining investment. The DNM is one of the departments administered by the Ministerio de Planificación Federal, Inversión Pública y Servicios [Ministry of Federal Planning, Public Investment and Services]. The Dirección Nacional de Planificación Estratégica Regional [National Directorate of Regional Strategic Planning] and the Servicio Geológico Minero Argentino [Geological and Mining Service of Argentina] (SEGEMAR) were under the authority of the Mining Secretariat of the DNM. The Cámara Argentina de Empresarios Mineros [Argentine Chamber of Mining Companies] (CAEM) is a civil association that advocates for development of the mineral industry. El Grupo de Empresas Mineras Exploradoras de la República Argentina (GEMERA), whose members are exploration companies of different sizes and origins, is a business association that is part of the CAEM. GEMERA partners with Provincial mining chambers to address

local and national mining issues (Grupo de Empresas Mineras Exploradoras de la República Argentina, [2012]; Ministerio de Planificación Federal, Inversión Pública y Servicios, 2014).

Argentina's *Código de Minería* [Mining Code] was enacted by the Argentine Congress on November 25, 1886. The Mining Code underwent significant revisions in 1993 with the enactment of law No. 22,224 (Mining Reorganization Law) and law No. 24,228 (Federal Mining Covenant); in 1995 with the enactment of law No. 24,498 (Mining Modernization Law), law No. 24,523 (creation of the National Mining Trade System of the Mining Secretariat), and law No. 24,585 (Environmental Protection Mining Law); and in 1997 with the passage of law No. 25,225 (Secretaría de Minería de la Nación, 2014).

Argentina's law No. 24,196 (the Mining Investment Law of 1993) provided incentives for companies to invest in mineral exploration, including a 30-year guarantee of fiscal stability for new projects, an exemption from import duties on capital goods, and an upper ceiling on Provincial mining taxes. This law also established an attractive environment for investment in mining activities by promoting and establishing guidelines for prospecting, exploration, construction, and commissioning of mining projects, as well as the expansion and modernization of existing productive assets at a time when mining was less important to the country's economy (Secretaría de Minería de la Nación, 2014).

In 2011, in an attempt to control inflation and the outflow of the Central Bank's foreign currency reserves, the Government issued Decree No. 1,722/2011, which requires that export revenues generated by the mining and energy sectors remain in or be repatriated to Argentina to be exchanged on the local currency market. This Decree appears to be a contradiction of Decree No. 753 of 2004 that authorized mining and oil and gas companies to take their export revenues out of the country but is similar to Decree No. 2,581 of 1964 that required energy companies to keep all export revenues in local markets (Buenos Aires Herald, 2011; Latin American Tax Newsalert, 2011).

Law No. 25,551 of 2011 establishes a domestic preference for local industry for most Government procurement if a domestic supplier's bid is only 5% to 7% higher than the foreign bid. In March 2011, the Argentine Senate approved an amendment to the law that would extend the "Buy Argentine" plan to include licensees and concessionaires of public utilities and other services, including mining and oil and gas companies. The amendment would also increase the price preference for local suppliers to 10%. The draft law was still pending in committees of the Argentine Lower House at yearend 2012 (Office of the United States Trade Representative, 2014, p. 6).

As the Government sought to replace imported freight transportation services, machinery, mining equipment, parts, and other services, an agency called the Mesa de Homologación Minera (MHM) [Mining Certification Board] was created to generate business opportunities for local mining suppliers. The MHM was tasked with promoting the replacement, when possible, of foreign suppliers with those of domestic origin by assessing and resolving issues of domestic supply and demand. In May 2012, two resolutions were issued—Resolution 12/2012 and Resolution 13/2012—that require mining companies registered in Argentina to use Argentine vessels to transport

mineral commodity exports from Argentina and to purchase domestic capital goods, spare parts, and services in accordance with the Government's import substitution policies. To increase development of domestic value-added production, export taxes are imposed on all but a few exports. In some cases, the export tax for raw materials is higher than the sale price of the processed product. Exports of hydrocarbons are indexed to world commodity benchmarks. In August 2012, pursuant to Decree No. 1513/2012, the Government extended the ban on ferrous scrap exports first imposed in 2009 for an additional 360 days (Instituto Argentino de Normalización y Certificación, 2014; Office of the United States Trade Representative, 2014, p. 2–5).

Earnings on exports of goods and services (including mineral commodity exports) must be converted to Argentine pesos on the local foreign exchange market in Argentina. Decree No. 1722/2011 eliminated the exceptions that had previously been granted to hydrocarbon and mining exporters, although revenues generated from exports of goods and services to Argentine foreign trade zones and from the reexport of some temporary imports were still exempt from the requirement in 2013. The time limits originally set for fulfilling the obligation to convert earnings into pesos ranged from 60 days to 360 days for goods and 15 days for services, and an unspecified portion of foreign currency earned through exports could be used for foreign transactions. In April 2012, however, the Government issued Resolution No. 142/12, which reduced the time limit for companies to convert their export earnings to pesos on the local foreign exchange market to within 15 days. This brought exports for some industries, including the mining industry, to a virtual halt. In response, the Government partially eased the requirement and revised the timeframes to between 15 and 360 days, depending on the exported product (Office of the United States Trade Representative, 2014, p. 5–8).

Argentina prohibits the import of many used capital goods, (although exceptions are in place for some industries, including mining), and restricts the import of any remanufactured goods, including earthmoving equipment. To restrict imports and protect the sectors deemed "sensitive," the Government limited the type of import licenses issued. Throughout 2012, about 600 tariff lines were subject to nonautomatic licenses, which resulted in complications for import partners. In January 2013, however, the nonautomatic import license requirements on iron, steel, and metal products and general and special purpose machinery were repealed (Office of the United States Trade Representative, 2014, p. 2–3).

Production

Production of primary aluminum in 2013 increased by 6.5% to a reported 440,176 metric tons (t), approaching the expanded installed capacity of 460,000 metric tons per year (t/yr) at Aluar Aluminio Argentino S.A.I.C.'s Puerto Madryn plant, which was the country's only primary aluminum producer. Gold mine output was estimated to have decreased by 7.3% in 2013 compared with that of 2012 to about 50,650 kilograms (kg) as increases in gold production at the Cerro Vanguardia, the San Jose, and the Manantial Espejo Mines were offset by decreases in production at the Caposo, the Gualcamayo, and the

Veladero Mines. The total amount of iron contained in pig and sponge iron increased to about 3.9 million metric tons (Mt), or by 6% compared with that of 2012. Argentina exports virtually all of its lithium production, and in 2013, 8,999 t of lithium carbonate was exported from Argentina compared with 9,723 t in 2012. The Salar del Hombre Muerto, which was operated by Minera del Altiplano S.A. (a subsidiary of FMC Corp. of the United States), was the only major commercial lithium operation active in 2013 (Instituto Nacional de Estadística y Censos, 2014c, p. 69; United Nations Statistics Division, 2014).

Structure of the Mineral Industry

The mineral industry in Argentina was composed of domestic and foreign private and public companies. In 2013, about 40% of the mining companies working in Argentina were headquartered in Canada. Several acquisitions were announced in 2013, including Las Opeñas gold project located in San Juan Province, the Cerro Samenta copper project located in Salta Province, and the San Jorge copper project located in Mendoza Province.

Teck Resources Ltd. of Canada announced that it would exercise its back-in rights for a 60% interest in Las Opeñas project from Genesis Minerals Ltd. of Australia by agreeing to spend \$1.2 million at the project. Teck planned to continue exploration at Las Opeñas by targeting a large mineralized system. Genesis had discovered wide zones of gold mineralization with associated lead, silver, and zinc during its first drilling program at Las Opeñas in 2012. The company reported that Las Opeñas had the potential to host a multimillion-ounce gold deposit in a large epithermal system. Mineralization is hosted within polymictic breccias and fine-grained sediments. Galena, pyrite, and sphalerite occur as disseminated mineralization and within crosscutting veinlets (Genesis Minerals Ltd., 2013).

Marifil Mines, Ltd. of Canada signed a definitive agreement with Southern Copper Argentina (an indirect subsidiary of Grupo Mexico S.A.B. de C.V.) whereby Southern Copper would acquire a 70% equity interest in the Cerro Samenta Mine by paying a total of about \$375,000 during a 4-year period, by spending at least \$4 million on exploration at Cerro Samenta, and by making contract payments on behalf of Marifil to two other property owners during a 6-year period. Southern Copper would be able to increase its interest in Cerro Samenta to 80% by providing Marifil with a bankable feasibility study within 7 years. In 2013, Southern Copper reported that its environmental report required for drilling had been approved and that the company had been carrying out geologic mapping at a scale of 1:25,000 and had collected and analyzed 338 rock samples (Marifil Mines, Ltd., 2013a, b).

In December, Coro Mining Corp. of Canada signed an earn-in agreement by which Aterra Investments Ltd. of Russia and Solway Industries Ltd. of Cyprus would acquire a 70% interest in the San Jorge project by paying Coro \$1.5 million within 24 months from the signing of the agreement and, among other terms, complete an independent bankable feasibility study. Aterra and Solway had the option to acquire 100% of the project by paying Coro \$3 million in cash at any time within 6 months from the signing of the agreement or \$5 million in cash at any

time within 18 months from the signing of the agreement. San Jorge is a hydrothermally altered porphyry deposit. Ore minerals include chalcocite, chalcopyrite, covellite, digenite, and malachite. Total reserves and resources at San Jorge as of March 2012 were reported to be 194 Mt containing 922,000 t of copper and about 30,000 kg of gold (Coro Mining Corp., 2013, 2014).

Mineral Trade

Argentina was a member of the Mercado Común del Sur (MERCOSUR) [Southern Common Market], along with Brazil, Paraguay, Uruguay, and Venezuela; the partner countries included Bolivia, Chile, Colombia, Ecuador, and Peru. Argentina remained a net exporter in 2013 as it had been every year since 2000, but the total free on board (f.o.b.) value of exports decreased by 17.5% to about \$81.7 billion from \$96 billion in 2012. Of that value, 28.4% was received by other MERCOSUR member or partner countries. The f.o.b. value of Argentina's exports, by economic area, included \$23.2 billion in receipts from MERCOSUR countries; \$15.2 billion from the Association of Southeast Asian Nations (ASEAN) member countries plus China (including Hong Kong and Macau), Japan, India, and the Republic of Korea; \$10.6 billion from the countries of the European Union (EU); \$7.6 billion from the North American Free Trade Agreement (NAFTA) member countries (the United States, Canada, and Mexico); \$3.9 billion from the Arab Maghreb Union and Egypt; and \$21.2 billion from the rest. Brazil was the leading recipient of Argentine exports, followed by the United States and Chile (Instituto Nacional de Estadística y Censos, 2014a, p. 3).

The value of Argentine imports in 2013, as reported in terms of cost, insurance, and freight (c.i.f.) arrangements, decreased by 7.7% compared with that of 2012. Of that value, 27.7% was imported from other MERCOSUR member or partner countries. The c.i.f. value of imports by economic area included \$20.4 billion in receipts from MERCOSUR member or partner countries; \$17.1 billion from ASEAN member countries plus China (including Hong Kong and Macau), Japan, India, and the Republic of Korea; \$13.5 billion from the countries of the EU; \$10.7 billion from the NAFTA member countries, \$19.2 million from the Arab Maghreb Union and Egypt; and \$11.6 billion from the rest. In terms of c.i.f. value, Brazil was the leading supplier of Argentine imports followed by China and the United States (Instituto Nacional de Estadística y Censos, 2014a, p. 3).

A total of \$5.2 billion worth of goods classified as mineral products was exported from Argentina in 2013. Of that value (the total of which accounted for 6.4% of exported goods), 70% was composed of mineral fuels, mineral oils and products of their distillation, bituminous substances, and mineral waxes. Argentina received \$11.9 billion worth of imported mineral products (which accounted for 13.1% of imported goods), 91.3% of which was composed of mineral fuels, mineral oils and products of their distillation, bituminous substances, and mineral waxes. Common metals and manufactured articles thereof traded between Argentina and other countries included aluminum, copper, iron and steel, nickel, tin, and other base metals. The value of exports of those goods was \$2.7 billion in 2013 (of which 46% was accounted for by copper and articles

thereof, and 28%, by aluminum and articles thereof). The value of imported common metals and manufactures to Argentina was \$3.6 billion (61% of which was composed of iron and steel and articles thereof) (Instituto Nacional de Estadística y Censos, 2014a, p. 11, 13).

Commodity Review

Metals

Aluminum.—Aluar was Argentina's only primary aluminum producer. In 2013, the company produced 440,176 t of primary aluminum and 25,600 t of manufactured aluminum products during its production year, which ended on June 30. For the year, 77% of Aluar's production was exported. Exports consisted of pure ingot (56%), billets (24%), wire rods (12%), and primary foundry alloys (8%). The primary aluminum and aluminum semimanufactures were received by other Latin American countries (38%), the United States and Mexico (about 37% combined), Asia (21%), and the countries of the EU (3%) (Aluar Aluminio Argentino S.A.I.C., 2014; Instituto Nacional de Estadística y Censos, 2014b).

Copper and Molybdenum.—In 2013, 37.4 Mt of ore was mined at Minera Alumbra Ltd.'s Alumbra Mine from which a reported 109,588 t of copper was produced. Production of copper in concentrate at Alumbra decreased by 19.3% in 2013 compared with that of 2012 as a result of continued lower mill head grade and a reduced recovery rate. Alumbra started commercial operations in 1997, producing 30,000 t of copper in concentrate that year. In the 2001–02 timeframe, a mine expansion plan was completed and the operation achieved maximum copper production of 204,027 t. In 2006, a molybdenum flotation plant near the existing Alumbra concentrator was approved, and commissioning was completed by yearend 2008. The estimated 2013 production in table 1 is based upon the average of production volume ratios for copper and molybdenum at the Alumbra Mine. The operation had an open pit mine and the capacity to process 120,000 metric tons per day (t/d) of ore into concentrate and dore from a sulfide porphyry deposit containing chalcopyrite, gold, molybdenite, and pyrite (Edelstein, 2008; Goldcorp Inc., 2009, p. 17; 2014, p. 44).

In May, Glencore International plc and Xstrata plc merged to form Glencore Xstrata plc. The ownership structure of Minera Alumbra Ltd., which operated the Agua Rica polymetallic porphyry project, thus became Glencore Xstrata (50% ownership), Goldcorp Inc. (37.5%), and Yamana Gold Inc. (12.5%). The Agua Rica deposit, which is located in Catamarca Province about 35 kilometers (km) from the Alumbra Mine, is a porphyry deposit containing copper, molybdenum, and a lesser amount of gold, and it has a polymetallic epithermal overprint. The deposit's copper resources are held mostly in covellite or chalcocite. Agua Rica remained a feasibility-stage project in 2013. As of yearend 2013, total reserves and resources at Agua Rica included 1.75 billion metric tons (Gt) containing 7.4 Mt of copper, about 308,000 kg of gold, 581,051 t of molybdenum, and 5,200 t of silver (Yamana Gold Inc., 2014).

In 2013, Glencore Xstrata continued work on the advanced feasibility study at the El Pachon project in San Juan Province, which had been wholly owned by Xstrata prior to its merger

with Glencore. As of yearend 2013, mineral reserves and resources at El Pachon totaled about 3.3 Gt containing 15.5 Mt of copper, 354,400 t of molybdenum, and about 6,800 t of silver (Glencore Xstrata plc, 2013, p. 16).

Gold.—In 2013, production from Argentina included 8,102 kg of gold from Anglo Gold Ashanti Ltd. of South Africa's (92.5%) Cerro Vanguardia Mine in Santa Cruz Province compared with 7,361 kg in 2012. The Cerro Vanguardia Mine commenced production in 1998. The highest reported mill head grade from Cerro Vanguardia was 15.1 grams per metric ton (g/t) in 1999, but the grade had remained between 5.5 g/t and 7.7 g/t since that time. The average mill head grade of the ore recovered in 2013 was 6.6 g/t gold compared with 6.5 g/t in 2012. The operation had an installed processing capacity of 3,000 t/d and produced dore from open pit and underground operations. Cerro Vanguardia is an epithermal deposit located in the central portion of the Deseado Massif. The ore body consists of low-sulfidation quartz veins cutting ignimbrites and volcaniclastic rocks. Veins consist mainly of andularia, quartz, and minor amounts of electrum, native gold, native silver, and silver sulfides. In 2013, Anglo Gold reported an updated reserve and resource estimate for Cerro Vanguardia. Total reserves and resources amounted to 48.9 Mt grading 2.6 g/t gold and 53.2 g/t silver for a total of about 130,000 kg of gold and 2.6 million kilograms (Mkg) of silver. The total reserve estimate included proven and probable reserves of about 19 Mt of ore containing 52,450 kg of gold and 994,500 kg of silver (AngloGold Ashanti Ltd., 2014, p. 136–138).

At Barrick Gold Corp. of Canada's wholly owned Veladero Mine, 19,935 kg of gold was produced from 29.1 Mt of processed ore compared with 23,822 kg of gold from 27.7 Mt of processed ore in 2012. Barrick expected to produce about 21,000 kg of gold in 2014. The average grade was 0.9 g/t in 2013 compared with 1.1 g/t in 2012. The Veladero Mine's first full year of production was in 2006. The highest reported average mill head grade from Veladero of 2.0 g/t was reported in 2006, but the grade had remained between about 0.9 g/t and 1.7 g/t since that time. The operation had the capacity to process 85,000 t/d of ore from an open pit mine into dore. Mineralization at Veladero is the result of epithermal alteration and infill of brecciated dacite and rhyodacite host rocks associated with the Cerro Pelado and the Filo Federico diatreme structures. Ore minerals include arsenopyrite and pyrite (Barrick Gold Corp., 2009; 2011, p. 3; 2014).

At the San Jose Mine [jointly owned by Hochschild Mining Plc of the United Kingdom (51%) and McEwen Mining Inc. of Canada (49%)], which was primarily a silver mine, 3,074 kg of gold was produced compared with 2,667 kg in 2012. McEwen expected the mine to produce about 4,800 kg of gold in 2014. San Jose commenced operations in 2007. The highest average grade of gold was 7.1 g/t in 2007, but the grade decreased each year until 2012, when it was 5.7 g/t. In 2013, however, the grade of gold was 6.4 g/t. The operation had the capacity to produce 1,500 t/d of ore from an underground mine into concentrate, dore, and precipitates. Total reserves and resources as of yearend 2013 included 6.3 Mt grading 496.9 g/t silver and 7.4 g/t gold for a total of 3.1 Mkg contained silver and 46,155 kg of gold. Mineralization at the San Jose Mine is controlled by

regional faults in a belt extending 15 km and is associated with breccia fill, stockwork, and veins in a low-sulfidation epithermal system of Jurassic volcanic and volcanoclastic rocks (Hochschild Mining Plc, 2009, p. 10–11; McEwen Mining Inc., 2014, p. 1–2).

Pan American Silver Corp. of Canada's wholly owned Manantial Espejo Mine in Santa Cruz Province, which is also primarily a silver mine, produced 1,892 kg of gold from 719,607 t of ore in 2013 compared with 1,348 kg from 734,355 t of ore in 2012. The Manantial Espejo Mine commenced operations in 2009. The average mill head gold grade was 2.8 g/t in 2013 compared with 1.9 g/t in 2012. The highest average grade of gold of 3.8 g/t was processed in 2009 and had decreased each year since that time. As of yearend 2013, total reserves and resources included 11.1 Mt grading 1.5 g/t gold and 110.1 g/t silver for a total of 1.2 Mkg of contained silver and 17,148 kg of gold. In February 2014, Pan American updated the reserve and resource estimate at the Manantial Espejo Mine to include proven and probable reserves of 4.3 Mt of ore grading 138.9 g/t silver and 2.1 g/t gold. Mineralization is associated with quartz veins at fault intersections in a high-level epithermal system. The operation had the capacity to process 2,000 t/d of ore from open pit and underground mining to produce dore (Pan American Silver Corp., 2012, 2014).

At Yamana Gold Inc. of Canada's Gualcamayo Mine in Santa Cruz Province, 3,742 kg of gold was produced compared with 4,582 kg in 2012. The decrease was owing to the mine's phase 3 transition to underground operations. The operation had the capacity to process 36,000 t/d of ore, and Yamana expected to produce about 5,300 kg of gold in 2014. At Gualcamayo, mineralization is associated with epithermal alteration from a Tertiary intrusive that cuts through thrustbed Paleozoic carbonate and clastic sediments (Yamana Gold Inc., 2014).

At Troy Resources Ltd. of Australia's wholly owned Casposo Gold Mine in San Juan Province, 2,155 kg of gold was produced from 427,709 t of ore in 2013 compared with 2,208 kg from 315,670 t of ore in 2012, which was the mine's first full year in operation after commencing production in 2011. The operation had the capacity to process 1,100 t/d of ore from open pit and underground mining to produce concentrates and dore. The average mill head gold grade was 8.0 g/t and 7.5 g/t in 2012 and 2011, respectively. In 2012, Troy Resources projected gold production for 2014, 2015, and 2016 of about 2,300 kg, 1,700 kg, and 949 kg, respectively. Mineralization at Casposo is associated with epithermal alteration by dike, stockwork, and vein intrusions into a rhyolitic to dacitic volcanic unit. Ore minerals include argentite, chalcopyrite, electrum, pyrite, and silver (Troy Resources Ltd., 2011; 2012a, p. 17; 2012b, p. 24–35, 35; 2013, p. 5).

Yacimientos Mineros de Agua de Dionoso (YMD) of the Catamarca Province's Fallaron Negro Mine had been in continuous operation since 1978. The operation was supported by partnerships with the National University of Tucuman and the government of Catamarca Province. The company produced gold and silver from low-sulfidation epithermal vein deposits. Production figures were not publicly available. YMD also held a 20% royalty share in the Alumbra operation.

Silver and Zinc.—The Manantial Espejo Mine produced about 97,781 kg of silver in 2013 compared with 112,985 kg in 2012. Pan American expected to process 3.8 Mt of ore in 2014. San Jose Mine produced 197,696 kg of silver from 6.4 Mt of ore compared with 185,145 kg of silver from 6.0 Mt of ore in 2012. The average mill head silver grade was 425 g/t in 2013. The silver grade had increased each year since 2010. Silver Standard Resources Inc. of Canada's wholly owned Pirquitas Mine in Jujuy Province produced 255,020 kg of silver and 12,247 t of zinc in 2013 compared with 268,236 kg of silver and 5,072 t of zinc in 2012. The volume of ore processed in 2013 was not available, and the average mill head gold grade is estimated to have been about 200 g/t based on data for the previous 4 years (that is, since the operation commenced commercial production). The operation had the capacity to process about 6,000 t/d of ore from an open pit mine to produce mineral concentrates. The Pirquitas deposit is an epithermal vein deposit. Ore minerals include cassiterite, miargyrite, pyrrargyrite, pyrite, and tetrahedrite (Minera Andes, 2011; Pan American Silver Corp., 2011, p. 9; Canada News Wire, 2014; McEwen Mining Inc., 2014; Silver Standard Resources, Inc., 2014).

Industrial Minerals

Lithium.—In 2013, ADY Resources Ltd. was producing lithium from its wholly owned integrated facility at the Salar del Rincon in Salta Province. The operation had the capacity to produce 1,200 t/yr of lithium carbonate from a pilot plant. ADY Resources was completing a feasibility study for constructing a plant to process 30,000 t/yr of lithium carbonate. In December 2013, Orocobre Ltd. of Australia announced that construction at its 66.5%-owned Salar de Olaroz brine project in Jujuy Province was 70% complete. Orocobre had begun commissioning the first production wells and filling the first evaporation pond in September 2013. The operation was expected initially to produce 17,500 t/yr of lithium and another 10,000 t/yr of potash within 2 years of startup. The operation's expected life was 40 years (Clarke, 2012).

Potash.—The total capital expenditure required to complete the Rio Colorado project was estimated to be \$5.9 billion by yearend 2012, but by the spring of 2013, Vale announced a revised estimate of \$11 billion. At yearend 2012, the project was about 45% complete and carried a total realized expenditure of between \$2.2 billion and \$2.5 billion. By March 2013, Vale had suspended the Rio Colorado project indefinitely, citing inflation and exchange rate fluctuations as the reasons for the suspension. Rio Colorado had been projected to be one of the largest foreign capital investments in Argentina's history and would have placed the country as the leading supplier of potash to Brazil. Brazil had relied upon imports from Russia and Canada for 90% of its potash consumption. Argentina had expected to employ 6,000 workers at Rio Colorado and had been counting on exports from the mine to maintain a trade surplus. Once the mine opens, it was expected to ramp up to a production volume of 2.4 million metric tons per year (Mt/yr) of potash and ultimately to produce 4.3 Mt/yr of potash after a second phase of development began. All production from the mine was to have been exported to Brazil (Kiernan, 2013).

Mineral Fuels

Petroleum and Natural Gas.—According to the U.S. Energy Information Administration (EIA), Argentina's Vaca Muerta shale formation in the Neuquén basin was estimated to contain 16.2 billion barrels of shale oil and 8.7 trillion cubic meters of natural gas. Vaca Muerta appears to be a lucrative field, but exploration would need to continue to determine the quantity of reserves. The EIA had previously downgraded its estimate for Argentina's Chaco Parana basin to 85 billion cubic meters of natural gas from an original 4.6 trillion cubic meters. Initial production trials by Exxon Mobil Corp. at Vaca Muerta resulted in production of 770 barrels per day (bbl/d) of oil; Chevron Corp. and Yacimientos Petrolíferos Fiscales S.A. (YPF) had formed a \$1.4 billion joint venture to develop another concession that had been producing 24,000 bbl/d. Obstacles to development still remained in the form of Government controls on pricing and export taxes on oil and gas output. The cost of developing Vaca Muerta was estimated to be at least \$140 billion, but energy companies were already steering clear of investing in Argentina's hydrocarbon sector owing to the increased costs of operating in Argentina, currency controls that increased the price of imported equipment, and the Government's nationalization in 2012 of Repsol YPF of Spain's share in YPF after Repsol made the big discoveries of shale gas at Vaca Muerta (Economist, The, 2014).

Crude petroleum production decreased by 2% in 2013 compared with that of 2012 to about 204 million barrels. About 54 different companies were involved in production of petroleum in the country in 2013; however, five companies accounted for 80.5% of the total. YPF accounted for 36.8% of total production; Tecpetrol S.A. (a wholly owned subsidiary of the Techint Group of Italy) accounted for 19%; Pan American Energy (Sucursal Argentina) LCC [an Argentine subsidiary of BP p.l.c. of the United Kingdom (60%) and the Bridas Corp. of Argentina (40%)] accounted for 17.6%; Sinopec Argentina Exploration Inc. (the Argentine subsidiary of China Petroleum and Chemical Corp.) accounted for 6.6%, and Pluspetrol S.A. of Argentina accounted for 3.7% (Instituto Argentino del Petróleo y del Gas, 2014).

Natural gas production decreased by about 5% in 2013 compared with that of 2012 to about 41.7 billion cubic meters. The leading producers were Total Austral S.A. and YPF, which accounted for 29.6% and 25.3%, respectively, of the total. Pan American Energy (Sucursal Argentina) accounted for 11.4% of the total; Petrobras Energia S.A. of Brazil, 8.5%; Tecpetrol, S.A. 3.2%; Pluspetrol, 3%; and Petrolera LF Co. S.R.L. of Argentina, 2.8% (Instituto Argentino del Petróleo y del Gas, 2014).

Outlook

In 2013, the value of the Argentine peso, when measured against the official exchange rate with the U.S. dollar, decreased by about 20%. The International Monetary Fund predicted that economic activity in Argentina would decrease in 2014. The country's high inflation, depleted foreign exchange reserves, and the discrepancy between the official and the market exchange rates were attributed to loose macroeconomic policies, and the

country's economic outlook was reported to be highly uncertain by early 2014 (International Monetary Fund, 2014, p. 61).

Argentina continued to develop its continental brine deposits, but global commodity prices and market demand were expected to affect the rate and magnitude of development. At the end of 2012, the combined design capacity of the country's advanced projects was nearly 78,000 t/yr of lithium carbonate equivalent, or nearly 15,000 t/yr of lithium metal, which would exceed the annual production of lithium metal from Australia (12,800 t in 2012) and Chile (13,200 t in 2012). Orocobre planned to commence commercial operations at Salar Olaroz in the third quarter of 2014 to produce battery-grade lithium carbonate. Other lithium projects that were projected to start up in 2015 included the Cauchari-Olaroz, the Salar de Diablillos, and the Sal de Vida projects. The San Jorge and El Pachon copper projects were expected to start up in 2015 and 2016, respectively (Jaskula, 2014; Orocobre Ltd., 2014).

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TABLE 1
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2009	2010	2011	2012	2013 ^c
METALS					
Aluminum, primary	412,594	417,088	416,177	413,395	440,176 ³
Cadmium:					
Mine output, Cd content	131	124	120 ^e	144 ^{r,3}	109 ³
Refined	36	32	31	37 ^{r,3}	35
Copper:					
Mine output, Cu content	143,084	140,318 ^r	116,829	135,837	109,588 ³
Refined, secondary ^e	16,000	16,000	13,000	13,000 ^{r,3}	14,000
Gold, mine output, Au content	46,588	63,138	59,140	54,651 ^r	50,650
Iron and steel:					
Metal:					
Pig iron	2,042	2,532	2,795	2,076	2,450 ³
Sponge iron (direct reduction)	807	1,566	1,675	1,607	1,466 ³
Total	2,849	4,098	4,470	3,683	3,916 ³
Ferroalloys, electric furnace: ^e					
Ferrosilicomanganese	6,644 ³	10,900	11,000	11,000	11,000
Ferrosilicon	11,300	11,000	11,000	11,000	11,000
Steel, crude	4,014	5,138	5,610	4,996	5,188 ³
Semimanufactures	4,991 ^r	6,537 ^r	6,853 ^r	6,371 ^r	6,654 ³
Lead:					
Mine output, Pb content	24,753	22,554	26,074	26,475 ^{r,3}	26,000
Refined:					
Primary	12,558	14,245	11,859	16,445 ^{r,3}	13,800
Secondary ^e	70,000	63,000	72,700	73,820 ^{r,3}	69,900
Total ^e	82,600	77,200	84,600	90,265 ^{r,3}	83,700
Molybdenum	556	468	820	1,600	845
Silver, mine output, Ag content	532,823	723,238	747,449	799,277 ^{r,3}	843,600
Zinc:					
Mine output, Zn content	31,869	32,566	33,975	34,000	47,700
Metal, smelter:					
Primary	32,989	39,540	42,067	37,797	36,712 ³
Secondary	2,639	3,163	3,230	2,844 ^{r,3}	2,640
Total	35,628	42,703	45,297	40,641 ^{r,3}	39,300
INDUSTRIAL MINERALS					
Asbestos	322	341	105	102 ^{r,3}	100
Barite	3,416	2,944	5,528	9,416 ^{r,3}	9,000
Boron materials, crude	505,983	622,968	648,806	479,412 ^{r,3}	500,000
Cement, hydraulic	9,385	10,423	11,592	10,716	11,892 ³
Clays:					
Bentonite	148,099	229,301	228,357	193,795 ^{r,3}	200,000
Common	6,941,736	7,313,420	8,323,888	8,034,080 ^{r,3}	7,600,000
Kaolin	78,792	78,722	54,166	66,574 ^{r,3}	70,000
Diatomite	62,270	54,467	60,651	278,126 ^{r,3}	100,000
Feldspar	213,551	217,213	216,721	273,896 ^{r,3}	230,000
Fluorspar	13,424	17,657	25,099	35,874 ^{r,3}	23,000
Gypsum, crude	1,355,260	1,346,535	1,452,797	1,432,517 ^{r,3}	1,400,000
Lithium:					
Carbonate	8,574	11,178	10,008 ^{r,3}	10,201 ^{r,3}	9,000
Chloride	4,279	6,644	4,009 ^{r,3}	3,741 ^{r,3}	4,200
Mica	8,668	9,638	10,226	5,785 ^{r,3}	7,500
Peat, agricultural (turba)	7,752	6,345	6,329	6,639 ^{r,3}	6,000
Perlite	21,802	27,182	27,446	24,663 ^{r,3}	25,000

See footnotes at end of table.

TABLE 1—Continued
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2009	2010	2011	2012	2013 ^e
INDUSTRIAL MINERALS—Continued					
Pozzolan ^c	6,000	7,582 ³	7,500	7,500	7,000
Pumice	7,020	7,582	6,445	6,252 ^{r,3}	7,000
Salt, common	1,477,532	1,532,124	1,888,676 ^{r,3}	1,843,975 ^{r,3}	1,500,000
Sand and gravel:					
Sand:					
Construction	27,183,525	31,345,764	33,455,151	32,133,801 ^{r,3}	31,000,000
Silica sand (glass sand)	364,157	531,161	516,772	615,256 ^{r,3}	500,000
Gravel	19,591,112	22,237,877	22,738,950 ^{r,3}	19,442,151 ^{r,3}	21,000,000
Stone:					
Basalt	2,116,582	1,652,032	917,294	3,147,922 ^{r,3}	2,000,000
Calcareous:					
Calcite	137,931	178,504	209,809	223,049 ^{r,3}	200,000
Dolomite, including crushed	1,252,643	1,524,713	1,589,599	1,561,861 ^{r,3}	1,500,000
Limestone	15,746,676	17,309,763	19,757,372 ^{r,3}	19,855,622 ^{r,3}	18,000,000
Marble, onyx, travertine	152,911	162,281	165,959 ^{r,3}	169,383 ^{r,3}	160,000
Shell, marl	353,137	425,872	467,978	487,633 ^{r,3}	425,000
Crushed, unidentified	19,663,410	22,237,877	22,638,657	20,000,000	20,000,000
Flagstone	197,877	147,923	184,023 ^{r,3}	189,493 ^{r,3}	180,000
Gemstones kilograms	119,650	45,054	45,000 ^e	11,916 ^{r,3}	20,000
Granite, in blocks	79,111	153,792	82,661	72,913 ^{r,3}	100,000
Quartz, crushed	218,218	228,679	232,461	216,697 ^{r,3}	200,000
Quartzite, crushed	946,682	1,164,418	1,292,503	1,370,053 ^{r,3}	1,200,000
Rhodochrosite kilograms	122,117	122,839	120,673	87,243 ^{r,3}	115,000
Serpentine, crushed	142,000	192,000	245,000	237,000 ^{r,3}	200,000
Strontium minerals, celestite	8,169	8,512	1,056	22,750 ^{r,3}	10,000
Sulfates, natural:					
Magnesium (epsomite)	1,650	1,704	1,724	1,784 ^{r,3}	1,800
Sodium (mirabilite)	18,267	16,225	12,126	48,389 ^{r,3}	20,000
Talc and related materials	22,762	24,820	24,379	23,576 ^{r,3}	25,000
Vermiculite	2,150	2,500	1,000	320 ^{r,3}	1,000
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen:					
Natural (asphaltite)	6,210	4,576	2,940	1,411 ^{r,3}	1,500
Byproduct of refinery	641,420	631,825 ^r	675,164 ^r	531,831 ^r	607,207 ³
Coal, bituminous thousand metric tons	181	140	178	245 ^{r,3}	250 ³
Coke do.	1,413 ³	1,398 ^r	1,393 ^r	1,474 ^r	1,343
Gas, natural, gross million cubic meters	48,418	47,499	45,620 ^r	44,123 ³	41,708 ³
Natural gas liquids ^e thousand 42-gallon barrels	10,100	10,000	10,000	10,000	10,000
Petroleum:					
Crude do.	211,255	224,077	207,960	207,878 ³	203,639 ³
Refinery products: ^e					
Liquefied petroleum gas do.	14,327 ³	14,563 ³	9,937 ³	10,000	10,000
Motor gasoline do.	47,700 ^r	48,600 ^r	54,100 ^r	57,700 ^r	55,000
Jet fuel (kerosene) do.	12,600 ^r	10,400 ^r	10,000	13,300 ^r	14,000
Kerosene do.	109 ^{r,3}	431 ^{r,3}	352 ^{r,3}	198 ^{r,3}	250
Fuel oil do.	2,319 ³	2,810 ³	2,123 ³	2,390 ³	2,400
Lubricants do.	2,456 ³	2,476 ^{r,3}	2,335 ^{r,3}	2,210 ^{r,3}	2,000
Other do.	188,993 ³	189,000	189,000	200,000	200,000
Total do.	268,504 ³	268,280 ³	267,847 ³	285,798 ^{r,3}	284,000

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. do. Ditto.

¹Table includes data available through September 1, 2014.

²In addition to the commodities listed, Argentina also produces ammonia, antimony, iron ore, mercury, and urea, but available information is inadequate to make reliable estimates of output.

³Reported figure.

TABLE 2
ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Aluar Aluminio Argentino S.A.I.C. [private, 77%; Government, 10%; National Social Security Administration, 13%]	Abasto, Buenos Aires Province, and Puerto Madryn, Chubut Province	460.
Boron	Borax Argentina S.A.	El Porvenir Mine and plant, Jujuy Province; Sijes, Porvenir, and Tincalayu Mines and plants, and Campo Quijano refinery, Salta Province	100.
Do.	Procesadora de Boratos Argentinos S.A. (Ferro Corp.)	Loma Blanca Mine, Jujuy Province, and plant at Palpala, Jujuy Province	36.
Do.	Ulex S.A. (private, 100%)	Pastos Grandes, Salta Province	2.
Cement	Cementos Loma Negra C.I.A.S.A. (private, 100%)	Buenos Aires, Catamarca, Cordoba, Corrientes, Jujuy, Neuquen, and San Juan Provinces	6,000.
Do.	Cementos Avellaneda, S.A. (Corporación Uniland S.A. and C. Molins International S.A.)	La Calera plant, San Luis Province, and Olavarría plant, Buenos Aires Province	2,800 cement, 220 lime.
Do.	Juan Minetti S.A. (Holcim Ltd., 100%)	Cordoba, Jujuy, and Mendoza Provinces	1,700.
Coal	Yacimientos Carbonífero Río Turbio S.A. (private, 100%)	Río Turbio, Santa Cruz Province	210.
Copper, gold, and molybdenum ¹	Minera Alumbrera Ltd. (Glencore Xstrata plc, 50%; Goldcorp, Inc., 37.5%; Yamana Gold, Inc., 12.5%)	Alumbrera Mine, Catamarca Province	40,000.
Fluorite	Fluorita Cordoba S.A. (private, 100%)	Mine and flotation plant, Cerro Negros, Cordoba Province	NA.
Gold and silver ¹	Cerro Vanguardia S.A. [AngloGold Ashanti Ltd., 92.5%, and FOMICRUZ S.E. (Government of Santa Cruz Province), 7.5%]	Cerro Vanguardia Mine, Santa Cruz Province	924.
Do.	Minera Santa Cruz (Hochschild Mining plc, 51%, and McEwen Mining Inc., 49%)	San Jose Mine, Santa Cruz Province	550.
Do.	Minera Argentina Gold (Barrick Gold Corp., 100%)	Veladero Mine, San Juan Province	28,000.
Do.	Troy Resources Ltd. (private, 100%)	Casposo Gold Mine, San Juan Province	438.
Do.	Pan American Silver Corp., 100%	Manantial Espejo Mine, Santa Cruz Province	730.
Do.	Yacimientos Mineros de Agua de Dionisio (Government, 100%)	Farallon Negro, Hualfin, and Belen Mines, Catamarca Province	NA.
Do.	Yamana Gold, Inc., 100%	Gualcamayo Mine, San Juan Province	13,000.
Iron and steel	Siderar S.A.I.C. (Ternium S.A., 60.93%)	San Nicolas, Buenos Aires Province	2,880 steel, 4,500 semimanufactures.
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. ²
Do.	Siderca S.A.I.C. (Techint Group)	Buenos Aires Province	900 steel, 670 DRI. ²
Iron ore ¹	MCC Minera Sierra Grande S.A.	Sierra Grande, Rio Negro Province	320 iron ore.
Lead and silver	do.	Palpala smelter, Jujuy Province	NA.
Lead, silver, and zinc	Silver Standard Resources Inc., 100%	Pirquitas Mine, Jujuy Province	2,000.
Do.	AR Zinc Group (100%)	Aguilar Mine, Jujuy Province	705.
Lithium metric tons	Minera del Altiplano S.A. (FMC Corp.)	Salar del Hombre Muerto, Salta Province; plants in Catamarca Province	23,000.

See footnotes at end of table.

TABLE 2—Continued
 ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity ¹
Petroleum	million 42-gallon barrels	YPF S.A.	Chubut, Formosa, Jujuy, La Pampa, Mendoza, Neuquen, Rio Negro, Salta, Santa Cruz, and Tierra del Fuego Provinces	366.
Do.	do.	Pan American Energy (Sucursal Argentina) LLC (BP p.l.c., 60%, and Bidas Corp., 40%)	Offshore Chubut and Santa Cruz Provinces	100.
Do.	do.	Chevron Argentina S.R.L. (Chevron Corp., 100%)	El Trapial field, Neuquen Province, and other concessions	46.
Do.	do.	Petrobras Energia S.A. (Petroleo Brasileiro S.A., 100%)	La Pampa, Mendoza, Neuquen, Rio Negro, Salta, and Santa Cruz Provinces	15.
Do.	do.	Petro Andina Resources Ltd. (Pluspetrol S.A., 100%)	Neuquen basin	10.
Do.	do.	Tecpetrol S.A.	Golfo San Jorge basin, Neuquen basin, Northwest basin	10.
Do.	do.	Total Austral S.A. (Total S.A., 100%)	Neuquen Province	NA.
Zinc		AR Zinc Group	AR Zinc smelter, Santa Fe Province	NA.

Do., do. Ditto. NA Not available.

¹Mill capacity per year.

²Abbreviations used in this table for commodities include the following: DRI—direct-reduced iron.