

ARGENTINA

By George Sanders and Nivaldo Rojas

The devalued Argentine peso (floated in January, 2002) has stabilised at around three to the US dollar, a level at which mineral explorers felt it should have been when exploration first boomed in the 1990s, and this painful devaluation of the country's currency is widely viewed as a prerequisite to economic recovery. Now that a new exploration boom is beginning, the cost of doing business will be more reasonable and better results can be expected.

Predictions of hyperinflation in Latin America's third largest economy have not materialised, at least so far, and the provisional government of President Eduardo Duhalde has served out its term. The new President, Néstor Kirchner, is allied with the Duhalde branch of the Peronist Justicialista Party, ensuring a measure of stability and continuity in the national government. Throughout 2002, Argentina negotiated with the IMF for new loans to dig itself out of an historic US\$141 billion default on its government debt, and new cash is expected to begin flowing soon. The government projects 3% GDP growth and 22% inflation for 2003 and hopes that the estimated 20% unemployment rate will improve. Mining is playing a key role in this hoped-for economic recovery. It is the only sector to have shown any significant increase in foreign investment thus far in 2003. At the same time, the federal government has to defend at least one new mining project in the face of some very strong environmental and social opposition.

Life had not been good for Argentines for quite some time leading up to and continuing through the default and devaluation crisis. The economy stopped growing in 1998, and went into free-fall in 2001 as the fixed dollar-peso exchange rate that had worked so well during the 1990s became a liability.

As the world economy worsened, beginning with the Asian crisis in 1997, Argentina lacked the strict discipline necessary to rein in government spending and borrowing, interest rates rose while at the same time they were falling in the US, and prices and wages fell. In the end, the government could not pay its foreign debt, and froze most bank deposits in a last-ditch effort to save the currency peg. This toppled the government of Fernando de la Rúa in December 2001.

Three attempts were made by the Peronist-controlled Senate to find a willing candidate for the job of President, and the runner-up in the 1999 election, Eduardo Duhalde, assumed the role in January, 2002. His first move was to devalue the currency and the anticipated orderly transition quickly collapsed into a free-floating peso. The average person's dollar deposits were frozen and converted into pesos, first, at 1.4 to the dollar, and then much higher as the currency spiralled lower. Numerous lawsuits were initiated and, as a result, some of the deposits were partially reimbursed either in Argentine pesos, dollars or government bonds. Salaries were maintained at their former levels in pesos, while prices of imports, and to a certain extent even domestic

goods, rose to international levels, provoking unemployment, bankruptcies and the closing of many international banks. To say that everything is fine today in Argentina and that the populace is content is to deny some very real slippage in everyone's standard of living and expectations for the future.

The biggest mining news of the year was the re-start of Barrick's Veladero and Pascua-Lama projects at the crest of the Andes in arguably, the largest undeveloped gold district in the world. Ownership structures of the Bajo de la Alumbrera copper-gold mine, the Cerro Vanguardia gold-silver mine and the large, undeveloped Agua Rica copper deposit have all changed over the past year. Exploration is heating up throughout the country, and this year's *Mining Annual Review* highlights Argentina's mineral potential in the hottest regions, from mines to advanced-stage projects and to the active exploration plays.

Although always difficult to quantify, the government's estimate of all mineral project commitments and buyouts in 2003 is US\$1.3 billion, while investment projected to 2006 totals US\$2.2 billion. The decade-long projection is US\$5-7 billion which the government hopes to attract to exploit about two dozen projects with estimated reserves worth some US\$50 billion. This compares favourably with the US\$7 billion invested in mining in the 1990s. Devaluation favours mining, industrial manufacturing and agriculture, and now, with the rise in metals prices, mining is at the forefront of Argentina's recovering economy. The National Mining Sub Secretariat breaks down the regional exploration drilling activity as follows: Central Cordillera 56%, Patagonia 25%, and the Puna (northwest Argentina) 14%.

The Mining Sub-Secretariat is now part of the Ministry of Production rather than Economy and is divided into three main branches, the Geological and Mining Service (SEGEMAR), the National Mining Directorate (DNM), and the Directorate of International Relations (IRD). The Sub-Secretary is a political appointment and generally changes with each new government, but the Mining Directorate, which formulates policy and tracks production and investment, has been a stable and highly effective group of professionals for over 12 years and is largely responsible for Argentina's modern mining success. Austerity has been the norm under the current Sub-Secretary and considerable achievements have been made in trimming costs while still being able to come to the miners' defence in keeping the national and provincial governments in line with the mining laws. The federal government was quick to defend the producing mines' rights to access dollars during the recent crisis.

The link between national mining policy and its ultimate application in the individual provinces is COFEMIN, the Federal Mining Council, made up of the heads of the individual provincial mining directorates and representatives of the National Mining Directorate. This body tackles reform of the mining code, the transfer of technology and information to the provinces, and the task of making mining compatible with all the economic, social and environmental issues throughout the country. Funding for COFEMIN's continued work is critical to getting mining's story out to a public frequently opposed to mining projects, and there is concern that austerity measures at the national level are not addressing the need for a strong Mining Council.

There are variations among all the provinces in the manner in which the new mining environmental laws are applied. In Chubut Province, where controversy over the environmental and social impact has delayed Meridian Gold's Esquel project, the provincial legislature recently changed the law under which the Director of Mines was the authority that applied the mining environmental law. Now, the Director of Mines is the environmental authority only at the exploration stage, while the Director of Environment is now the authority for exploitation. Mendoza Province's administration is also a mix of authority between the environmental and mining directorates, while in all other provinces the mining environmental laws are administered by the mining authority (at least for the time being). In Chubut, the provincial legislature has voted to ban all surface mining and to ban all mining that uses cyanide, and also has voted to rescind its adherence to the federal mining pact that enabled the renaissance of mining exploration in the 1990s and the governor has signed both these bills into law even though they are in conflict with existing national laws. The federal government is weak at the moment, and the opposition forces are going for the throat, claiming that the federal government is not protecting the local communities on these highly emotional issues

Finding the money to keep the tenure-tracking modernisation programme moving ahead is also of great concern to the federal Mining Sub-Secretariat. The Patagonian provinces did the job themselves because their tenure maps were clean and they were able to start from scratch with the latest information technology. Substantial progress has been made in the north, specifically in Salta, Catamarca, Mendoza and Neuquén provinces. The provinces that are still lagging behind in this process of transparency and efficiency in staking ground are San Juan, San Luis, La Rioja and Jujuy. Part of this task has been taken up by the Instituto Geográfico Militar with its Sistema Única de Información Minero (SUIM) programme. Co-operative mineral exploration programmes with Canada and smaller programmes with other nations and universities continue, but the long-running Regional Mineral Exploration in Northwest Argentina programme with Japan International Co-operative Agency has come to an end. Work continues on a Bolivia-Argentina Cross Border Mining Treaty modelled along the lines of the highly successful and progressive treaty with Chile.

The mineral potential of Argentina can be divided into six main regions:

- The Puna (northwest Argentina provinces of Jujuy, Salta, Tucumán, Catamarca and La Rioja) hosts potential for large copper, gold, silver, tin, lead and zinc deposits and ferrous minerals; and its salars (playas) have potential for large deposits of borates, sulphates, common salt, and lithium brines.
- The Northeast (provinces of El Chaco, Formosa, Entre Rios, Corrientes, Misiones and Buenos Aires) has potential for diamonds, nickel, amethyst, limestone and ornamental stone.

- The Centre (provinces of Santiago del Estero, Cordoba, San Luis and the north portion of La Pampa), has potential for gold, porphyry copper, nickel-platinum and manganese deposits, beryl and other precious stones, ornamental stone, silica, feldspar and common salt.
- The Central Cordillera and PreCordillera (provinces of San Juan, Mendoza, Neuquén) has proven potential for large porphyry copper and gold deposits, and also chromium and talc, potash, aluminium sulphates, sulphur, gypsum and limestone.
- Patagonia (beginning in the southern part of La Pampa-Neuquén and continuing to Rio Negro, Chubut, Santa Cruz and Tierra del Fuego provinces), has potential for large epithermal gold and silver deposits, polymetallic lead-zinc deposits, bentonite, kaolin and ornamental stone.

Puna

Jujuy Province: Mina Aguilar is a stratiform lead-zinc deposit in Ordovician sediments that has been mined more or less continually since the 1930s. The mine was to close at the end of 1990, but discovery of the distal Esperanza orebody and deeper reserves at the Aguilar deposit gave the mine a new lease on life. The owner Comsur SA, a Bolivian mining company, chose to invest US\$12 million in 2001 for a new processing plant and a diesel to natural gas upgrade for the existing generator, plus a natural gas pipeline connecting the mine with the Gasoducto Nor-Andino at Tres Cruces. The mine produces approximately 2,000 t/d of combined 11% Pb-Zn ore averaging approximately 3.24% Pb, 7% Zn and 85 g/t Ag, and has a reserve plus resource base of approximately ten years. Jujuy Province allows a 1% deduction of exploration expenses from the 3% federally- mandated after-cost royalty.

Silver Standard Resources has acquired a 43.4% minority interest in the Pirquitas mine from Highwood Partners LP (an affiliate of Elliott Associates LP), which, together with Stonehill Capital Management of New York (56.6%) are private hedge funds that received the local company, Sunshine Argentina, in a bankruptcy settlement with Sunshine Mining Corp. Highwood Partners has agreed that Silver Standard will be operator of the project and, until such time as silver prices warrant a production decision, the property will be kept on a care- and-maintenance basis and costs will be shared pro rata.

Pirquitas is the southernmost of the 'Bolivian tin belt' type deposits at the southern end of the Altiplano where it changes to the more rugged Puna physiographic province. This underground mine operated from 1935 until the 1980s, exploiting high-grade tin-silver veins. Sunshine purchased a 100% interest in the Pirquitas project in 1995 and by 2000 had spent over US\$25 million to define a significant supergene silver-enrichment blanket amenable to modern open-pit mining methods, with 30.4 Mt of proven and probable reserves averaging 128 g/t Ag, 0.17% Sn and 0.81% Zn at a 40 g/t Ag cut-off grade. Potential exists to increase reserves substantially once mining begins, allowing currently inaccessible areas to be reached for exploration drilling. Sunshine Argentina holds all of the surface rights covering the mineralisation

and planned mill and plant facilities. The project is unencumbered by any royalties other than the 3%, mine-mouth (after cost) royalty due to Jujuy Province following federal guidelines that will be in force for a 30-year period under existing provincial law. The project is fully permitted for production with an operating permit granted in July 1999.

Cardero Resource Corp. is preparing to drill at the La Providencia silver mine in Jujuy as part of its Olaroz project that also includes the Chingolo and Ramona prospects. Significant values of Ag-Cu-Pb-Zn have been found in structural zones cutting favourable lower Palaeozoic sediments. The Providencia deposit was discovered during a UN-sponsored regional exploration programme in the 1970s and high-grade silver was mined underground from 1988 until 1996. Canadian Junior Mena Resources is actively exploring in Jujuy and Salta provinces.

Salta Province: One of the most significant recent exploration advances in Salta's Puna region is the recognition of magnetite-rich, igneous-hosted systems with Ca-Na-K alteration that show similarities to both porphyry copper and iron oxide-copper-gold deposit types, as exemplified by Candelaria (Chile) and Salobo (Brazil). The most significant of these is Mansfield Mineral's Rio Grande prospect where a large magnetite-biotite alteration system contains consistent highly-anomalous Cu-Au values in trenches and limited drill holes. Rio Tinto recently handed back the Arizaro-Lindero Fe-Cu-Au prospects to Mansfield after two drilling campaigns that discovered low grade Au-Cu mineralisation. From the 11-hole programme at Lindero, Mansfield estimates that there is a potential resource of at least 25 Mt at 1.2 g/t Au within a broader zone of consistent lower- grade gold mineralisation in a quartz stockwork with minor copper. Mansfield also had some success at its Aguas Calientes prospect where limited drilling came up with anomalous Au-Ag intercepts in an epithermal, high sulphidation system that has recently been shown to have a much wider footprint than originally discovered.

Corriente Resources has sold its 100% interest in the Taca Taca porphyry-copper project to CRS Copper Resources Corp. Taca Taca was drilled previously by several companies and contains a resource of some 400 Mt at 0.6% Cu and 0.25 g/t Au to a 300 m depth. Cerro Samenta North, formerly owned by Mansfield, has porphyry-copper potential that was only tested by three holes before a legal dispute ended the programme.

Catamarca Province: Canadian junior, Wheaton River Minerals Ltd, acquired Rio Tinto's 25% share and subsequently half of BHP Billiton's 25% share in Minera Alumbrera Ltd, the Argentine company that operates the Bajo de la Alumbrera mine and associated facilities, thus catapulting Wheaton River into the ranks of the world's mid-tier gold producers. (The US\$210 million price for the Rio Tinto share in Alumbrera included acquisition of the Peak Mine, a smaller gold producer in Australia.) Northern Orion initially bid US\$180 million for BHP-Billiton's share but Wheaton River exercised its pre-emptive rights to block the purchase. In the end, however, Northern Orion reached an agreement with Wheaton River and was able to purchase half of the BHP

Billiton share. Sale of the BHP-Billiton stake is expected to be finalised by mid-2003. MIM Holdings (X-Strata) remains the majority shareholder in Minera Alumbrera, with 50%. Last year's US\$40 million mill expansion increased the rate of production by 30%, and the active mine life is projected to be 8.5 years from 2003, producing 190,000 t/y of copper-in-concentrate and 600,000 oz/y of gold contained in concentrate and doré. This will rank Bajo de la Alumbrera as the 14th largest gold mine and the 9th largest copper mine in the world. There is an additional period of about two years at the end of mine life when low-grade stockpiled ore will be processed at diminishing rates of gold and copper production.

Commercial production from the project began in February, 1998, and ore reserves at that time were 767 Mt at an average grade of 0.51% Cu and 0.64 g/t Au. Low metal prices and additional drilling led to a revised ore reserve estimate in 2000 that subtracted 172 Mt from the original project ore reserves. The June, 2001 ore reserves stood at 385 Mt in the proven and probable category, averaging 0.53% to 0.57% Cu and 0.63 g/t to 0.67 g/t Au at a cut-off grade of 0.27% Cu-equivalent. The deposit has a high-grade core of hard, silica and magnetite-bearing potassic alteration with around 1 g/t Au and 1% Cu. This has been selectively mined to maintain project expectations, creating pit slopes steeper than originally designed and leaving much low-grade mineralisation behind. Firming of both copper and gold prices means that Alumbrera will regain a portion of the reserves it was forced to subtract, and recent announcements indicate that mine life may be extended by one and possibly two years as a result. An intense exploration effort by MIM Holdings to locate additional reserves around the Bajo de la Alumbrera mine at Bajo Agua Tapada, Bajo de las Pampitas, and Bajo San Lucas was discouraging.

Minera Alumbrera Ltd, the operator of the project, pays a 3% after-cost royalty to Catamarca Province as per the applicable legislation. Mining takes place under a joint-venture agreement with the owner of the mineral rights, Yacimientos Mineros de Aguas de Dionisio (YMAD), a statutory corporation with representatives from the provincial government of Catamarca, the National University of Tucumán and the National Government of Argentina. The agreement gives YMAD 20% of the net (before tax) proceeds once the project capital plus interest has been repaid on the US\$1.2 billion mine project. The mine has not yet recovered its capital investment. YMAD has received, as per the agreement with Minera Alumbrera Ltd, advance payments which amount to US\$10 million (US\$2 million per year as from commencement of commercial production).

BHP Billiton has sold its 72% share in the large Agua Rica porphyry copper prospect located 34 km east of the Bajo de la Alumbrera mine for US\$12.6 million to minority owner Northern Orion. This was a prospect originally called Mi Vida that was identified in the late 1960s and was first explored shortly after by Cities Service. American Resources acquired Agua Rica in the early 1990s and transferred it to Northern Orion. BHP optioned the property and discovered a strong chalcocite-enrichment blanket in an unusual location under steep, rugged terrain on the desert valley slopes. Engineering challenges to unlocking the Cu-Au-Mo porphyry potential have so far

prevented this project from moving forward despite BHP's expenditure of almost US\$50 million in exploration and pre-feasibility work that included a bulk sampling adit completed in 1999 just before the project was terminated. Reserves at Agua Rica are 750 Mt averaging 0.66% Cu, 0.23 g/t Au and 0.037% Mo at a cut-off grade of 0.4% Cu. The reserves include a high-grade portion of 167 Mt at 0.99% Cu, 0.32 g/t Au and 0.036% Mo at a cut-off of 0.7% Cu. Unlike the Bajo de la Alumbrera mine, Agua Rica was staked on open ground and has no underlying provincial carried interest. Northern Orion is reported to be studying the feasibility of transporting slurry concentrate from Agua Rica via pipeline through 15 km of tunnels and overland to the Alumbrera mill 34 km to the west.

The Diablillos Project near Salar del Hombre Muerto on the Salta side of the Salta/Catamarca border was acquired by Silver Standard Resources from Pacific Rim in 2002. Open-pit resource estimates by Pacific Rim on this volcanic-hosted epithermal precious metals prospect, discovered by BHP in the late 1980s and subsequently explored by Barrick, stand at 49.5 Mt at 68.3 g/t Ag and 0.42 g/t Au at a cut-off grade of 0.4 g/t Au-equivalent. At the 0.8 g/t Au-equivalent cut-off grade required for a standard milling operation, Diablillos contains a resource of 30.7 Mt at 92.7 g/t Ag and 0.60 g/t Au.

Near Diablillos (and just south of the provincial border in Catamarca) is Condor Yaku, consisting of two vertical breccia bodies. The best defined body (Southern Outcrop) is 150 m in length and 15-20 m wide with drill intercepts up to 13 g/t Au, 108 g/t Ag and 1.6% Cu.

The Farallón Negro gold mine operated by YMAD near Bajo de la Alumbrera is the only working mine remaining from the days when the Argentine state-controlled both mining and oil production. Its low sulphidation, quartz-carbonate vein system with grades of 5-7 g/t Au is of some interest, and it has been offered repeatedly to foreign companies for joint venture. However, it comes with several million dollars liability to cash out pensions and terminations of the approximately 2,000 persons still on the state company's payroll. YMAD recently announced a production increase from 8,900 to 14,600 oz/y Au which, it says, will cover the shortfall created when Minera Alumbrera's five-year, US\$2 million per annum advance payments expired in early 2003. Under federal law, all state mining companies are prevented from acquiring any additional mining rights.

La Rioja Province: Most of the Famatina District was formerly a Provincial Reserve Area and is now controlled by Yacimientos Mineros La Rioja SA (YAMIRI), a private company. It is a large, geologically attractive area with both high sulphidation gold veins and underlying porphyry copper-gold potential. CRA explored Famatina during the first exploration boom in the early to mid 1990s, and in 2000 Corriente Resources took an option and conducted limited drilling on the peripheral, high sulfidation epithermal veins at La Mejicana.

Golden Peaks Ltd is continuing with exploration for gold and silver on its Sierra de las Minas property in the eastern portion of La Rioja Province

without Mitsubishi Materials Corp. Phase 5 drilling is under way, and the company has recently added to its land package.

The Central Cordillera and Precordillera

San Juan Province: Field work resumed at the start of the austral summer in late 2002 on Barrick Gold Corp.'s Veladero project in the high cordillera. Suspended due to low gold prices in 2000, Veladero, and nearby Pascua-Lama, are key to Barrick's worldwide growth plan. These two projects were consolidated by Barrick's takeover of Homestake in 2001 and represent a 25 Moz gold resource. Both are Tertiary age, high-sulphidation epithermal gold-silver deposits at the northern end of Chile's El Indio District.

Pascua-Lama is hosted in basement granites of Permian age, and proven and probable reserves, as of 2001, were 269 Mt averaging 1.95 g/t Au and approximately 66 g/t Ag at a 1.1 g/t Au cut-off grade. The separate Filo Norte area, near the limit with the adjacent Veladero project, contains an additional 16.3 Mt of proven and probable reserves averaging 1.2 g/t Au and approximately 23 g/t Ag. Recovery of metals at Pascua-Lama will be via milling of a non-refractory ore that will be processed by conventional cyanide leaching to produce gold-silver doré, and a refractory ore that will undergo conventional flotation concentration to produce a copper-silver-gold concentrate.

The Veladero deposit is hosted in Tertiary volcanics at the southeast end of the district. The ore is oxidised and amenable to heap leaching, which has led Barrick to commit all its efforts towards putting Veladero into production first. As of January 1, 2001, Veladero's measured open-pit reserves totalled 194.3 Mt averaging 1.46 g/t Au and approximately 21 g/t Ag at a cut-off grade of 0.5 g/t Au. Included is a high-grade portion of the deposit containing 18.5 Mt at 4.97 g/t Au and 47.9 g/t Ag. A feasibility study for the US\$425 million Veladero project, completed in late 2002, estimates production of 530,000 oz/y of gold starting in 2006 for a 13-year mine life. Ore will be crushed in two stages, and gold recovery is estimated at 73% (no figures for silver have been given).

Barrick has opted not to continue work on the planned low-elevation access road to the Valle del Cura from San Juan and, instead, is upgrading the existing road over the Conconta pass. Engineering, supply and construction services are being provided by an SNC Lavalin-Techint and site construction is planned to begin in September 2003. Environmental permits have been applied for and are expected to be approved by September 2003.

Pascua-Lama's development will be sequential with Veladero's rather than competing for resources. Feasibility on the US\$1.18 billion project is due to be finished in 2004, construction start up is expected in 2005, and production of 800,000 oz/y of gold is planned for 2008 (no figures for silver have been given). Pascua-Lama enjoys the benefit of falling within the Chile-Argentina cross-border mining treaty that will facilitate development from both sides of the border. The first protocol agreement, reached in 1998 before the actual treaty was signed, was fundamental to Barrick's ability to explore the deposit, which is inaccessible from the Argentine side during the winter months. The

feasibility study will investigate a cross-border conveyor tunnel from the future Pascua pit to the mill which will be located in the Río Túrbio valley in Argentina within a single mining-operation area under the Pascua-Lama Protocol. The Chile Argentina Mining Treaty allows, in principle, for the accounting of ore produced within the respective sovereign territories for tax purposes, although the details remain to be worked out.

The Lama portion of the Pascua-Lama project is on private ground staked by St Joe Minerals during El Indio district exploration in the early 1980s. Following federal guidelines, production from both the Lama and Veladero portions of the project will pay a 3% after-cost royalty to the San Juan provincial government. Veladero, however, has an additional royalty burden on project economics, over and above the 3% provincial royalty, as it was a Provincial Reserve Area, and mining rights are owned by the San Juan provincial mining company, Instituto Provincial de Exploración y Explotación Minero (IPEEM). Barrick's wholly-owned subsidiary, Minera Argentina Gold SA, recently reached a royalty agreement with IPEEM to mine the Veladero and Ursilana Sur deposits. Terms have not been disclosed, but the basic structure of the deal will give IPEEM either a free net (before tax) carried interest from the start or a percentage stake of the Veladero net (before tax) proceeds once the project capital plus interest is repaid.

Noranda purchased El Pachón copper deposit for US\$30 million from Cambior and Comsur in 2001, and has been drilling the property to update a 1997 feasibility study. This stated reserves of 880 Mt averaging 0.62% Cu, 0.015% Mo, 0.02 g/t Au and 2.4g/t Ag, based on a cut-off grade of 0.4% Cu and a US\$1.00/lb copper price. El Pachón is one of one of the world's largest porphyry copper systems. The larger half, Los Pelambres, lies across the border in Chile, where Antofagasta Minerals plc invested US\$1.36 billion in 1999 and is currently producing well in excess of 300,000 t/y of copper. El Pachón was the first 'straddle' project envisioned by the Argentina-Chile Mining Integration treaty and, together with Pascua-Lama to the north, was covered by a protocol between the two countries well before the formal treaty was signed.

Rio Tinto has begun exploration on a long-delayed programme at El Altar in the San Juan Cordillera. Encouraging Cu-Au values have been received from the first two holes in a five hole drilling campaign.

Tenke Mining Corp. has acquired an interest in TNR Resources' Batidero project immediately east of the Vicuña project, which straddles the Chile-Argentina border approximately 60 km north of Pascua-Lama. The target at Batidero is 'Veladero-type' bulk tonnage, epithermal gold mineralisation. Tenke came close at Vicuña when Rio Tinto drilled significant anomalous Cu-Au-Ag in 2001-2002, but handed the property back when it did not meet Rio Tinto's investment criteria.

The Mogote property, at the southern border of the Vicuña prospect, was also joint ventured and dropped by Rio Tinto. The owner, IMA Resources, subsequently entered into a joint venture with Amera Resources to conduct

further field work to identify drill targets based on the previous encouraging results.

Intrepid Minerals Corp. is exploring the Casposo gold-silver deposit that was discovered in 1998 by Battle Mountain Gold. Upon taking over Battle Mountain, Newmont simply dropped the property. Mining rights were picked up by private individuals, and Intrepid has the right to earn 100% of the project. Casposo is a low-sulphidation epithermal vein system 3 km long within a belt of hydrothermally altered felsic Triassic volcanics that extends for over 20 km. Mineralisation is also Triassic in age, and Casposo is the first significant Triassic epithermal deposit to be discovered in the Central Cordillera. Battle Mountain developed an inferred resource in the Kamila zone of 1.2 Mt at 12.7 g/t Au and 174 g/t Ag. Intrepid is actively working to define the resource and explore other vein targets at Casposo.

Viceroy Resource Corp. kept its Argentine land holdings intact during 2002 and announced its intention to return and explore with a new company, Viceroy Exploration Ltd. Viceroy spent over US\$5 million exploring the Gualcamayo project in San Juan and southern La Rioja provinces and in 2001 developed an indicated open-pit resource at the Quebrada del Diablo zone of 12.7 Mt averaging 1.2 g/t Au and an additional 22.4 Mt at 1.0 g/t Au using an 0.6 g/t Au cut-off grade. This epithermal-style, disseminated gold mineralisation is separate from substantial resources indicated in the skarn portion of the system explored by Anglo American in the late 1980s.

Mendoza Province: The Valle de Uspallata graben extends from San Juan southward to northern Mendoza Province and hosts a number of porphyry copper and copper-gold prospects. Chief among these is Northern Orion's San Jorge deposit in Mendoza Province, with an indicated and inferred resource of 57.3 Mt averaging 0.61% Cu at a 0.25% Cu cut-off grade based on projected open-pit mining and heap-leaching of mixed copper oxide and chalcocite for SX/EW recovery. Pre-feasibility studies indicate that this project should be economic owing to its low elevation and access to infrastructure, but no development plans have been announced.

The other undeveloped porphyry copper prospect in this trend is Paramillos Sur, discovered by the UN in the 1970s. Mendoza's high cordillera contains a number of relatively unexplored porphyry copper and copper-gold prospects, including Santa Clara, Portillo, Cerro Bayo, Río Barroso and Cerro Amarillo. Tenke Mining has announced a joint venture to explore for porphyry copper and gold in Mendoza, and Anglo American's base metals group is actively exploring in the region. In the extreme south of Mendoza, and extending into La Pampa Province, there is a zone of gold and copper-gold prospects in lower Mesozoic rocks (San Rafael Block) including the gold veins at La Cabeza and the copper deposit at Lihuel Calel. The La Cabeza low sulphidation epithermal gold deposit is 100% owned by Canadian company Exeter Resource Corp. and contains an estimated inferred resource of 6.8 Mt grading 2.8 g/t Au a cut-off grade of 1.0 g/t Au within five near-surface vein and breccia systems. The project is called Agua Nueva, and pre-feasibility drilling and other work is planned for 2003.

Neuquén Province: After an initial spurt of activity in the early 1990s, the virtual stranglehold placed on mineral tenure by the provincial mining company, Corporación Minera de Neuquén (Cormine), has been detrimental to exploration in Neuquén. The province recently dissolved Cormine and has announced its intention to put all its holdings out for bid. Hopefully, this action, coupled with a modernised tenure-tracking system will promote exploration, but from past experience in other provinces, the terms for participation are likely to include excessive option payments and free-carried interest. Minera Andacollo Gold, a small company with Canadian and Chilean investors, is mining about 25,000 oz/y of gold from veins at the Erica and Sofía mines in the Andacollo district.

Patagonia

Río Negro Province: In the cordilleran portion of Río Negro Province, Aquiline Resources has acquired the Calcatreu gold project from Newmont. This former Normandy-La Source property is a low sulphidation epithermal Au/Ag system located approximately 200 km northeast of Meridian Gold's Esquel project and consists of a large land package containing eleven separate quartz veins. Work is under way to complete an independent technical report to confirm a resource figure on the project. Los Menucos area in the centre of the province is seeing ongoing exploration for high sulphidation epithermal gold deposits in Mesozoic acid volcanic rocks of the large Somuncurá Massif. IAMGold encountered encouraging drill results at the Cerro La Mina, Cerro Abanico and Dos Lagunas prospects. Patagonia Gold SA, a recently-established Argentine company 50% owned by UK-based HPD Explorations Ltd, is exploring Apac Minerals' (Arminex) ground at the Cuya and El Puesto prospects at Los Menucos. Golden Peaks recently optioned the Tanque Negro property from Rio Tinto.

Chubut Province: Meridian Gold's Esquel project has run into strong opposition on both social and environmental grounds, and projected feasibility study completion and mine construction targets will not be met. The project is being attacked from every conceivable angle by uninformed domestic and international anti-mining forces coming to Esquel to mobilise public opinion, notably Greenpeace and the coalition behind Montana's recent anti-cyanide initiative. In February 2003 a local court issued a decree halting work on the project, but it was quickly overturned by the province. Anti-mining forces organised a non-binding referendum in March and voters overwhelmingly rejected the project. Meridian announced in April that it was pausing with the project in order to complete a water-quality study and address project alternatives within the existing, December 2002, Environmental Impact Study.

Meridian Gold's wholly-owned subsidiary, Minera El Desquite SA, holds the mining rights to the Esquel deposit. Based on a 2001 prefeasibility study, Esquel projects open-pit measured and indicated reserves converted into mineable reserves (at a 1 g/t Au cut-off grade) at 10.4 Mt averaging 8.5 g/t Au and 15 g/t Ag. The total capital cost of the project, estimated in the 1991 study, was US\$131.5 million based on a 500,000 oz/y production rate. Meridian now estimates production of 300,000 oz/y at a capital cost of

US\$100 million. The mining plan will include the Galadriel, Galadriel Sur, and Julia and Elena Norte vein systems. These are part of a structure, hosted within volcanic rocks, extending for 2.4 km and containing a number of separate shoots, lying within a 1 km wide by 20 km long mineralised corridor in the Cordón de Esquel. The gold-silver ores are amenable to conventional milling with high recoveries.

The Esquel deposit is on privately staked ground, and Chubut Province will receive a 2% after-cost royalty following federal guidelines. Meridian Gold is committed to obtaining the local community's understanding and support, and is working with government authorities at the local, provincial and national level to advance the project, the first stage of which will be to complete a full feasibility study. The national Mining Sub-Secretariat and the Federal Mining Council (COFEMIN) have stepped up efforts to stress that the mine plan will be carried out in strict compliance with all federal and provincial regulations, and that mine development would bring considerable economic growth, employment and infrastructure improvements to the region.

IMA Resources has discovered significant bonanza-grade silver-copper-lead mineralisation in structures at surface on Navidad Hill at its 100%-owned Navidad project, a grass-roots discovery in central Chubut. Replacement-style mineralisation also occurs within the 8 km by 3 km prospect area. IMA is continuing to explore low-sulphidation, vein-hosted gold mineralisation at its Las Bayas and Penascudo projects elsewhere in the province.

No work was done in 2002 on the 277,000 ha claim block comprising the Tecka platinum-palladium project in west central Chubut controlled by junior explorer Consolidated JABA. In addition to elusive PGM anomalies in layered mafic and ultramafic rocks, the complex and its host rocks are cut by several areas with extensive quartz veining, hydrothermal alteration and anomalous surface Au-Ag-Cu values, chiefly the Quichaura South-El Sauce and Tres Lagunas prospects.

Santa Cruz Province: AngloGold paid US\$90 million for Perez Companc's share of Cerro Vanguardia SA which operates the Cerro Vanguardia mine. AngloGold was taking advantage of the forced divestment of the non-core assets of Argentina's second largest oil and gas producer when Perez Companc was purchased by Brazil's Petrobras SA. AngloGold now controls 92.5%, while Fomento Minero de Santa Cruz Sociedad del Estado, known as Fomicruz, the province's state mining company, will maintain its 7.5% free-carried interest in Cerro Vanguardia SA. The company has the right to exploit the gold/silver veins for a period of 40 years from the signing date of the exploitation agreement in 1996. The US\$270 million project produced its first doré at the end of 1998. Following federal guidelines, the Cerro Vanguardia mine pays an after-cost royalty to the province of 1% of the value of mine production.

Cerro Vanguardia produces in excess of 260,000 oz/y of gold and 2.0 Moz/y of silver from steep-sided, open pit 'slot cuts' on 25 separate quartz veins. The Cerro Vanguardia District covers over 500 km² near the centre of the

Deseado Massif, a Jurassic-age ignimbrite plateau. Epithermal, low-sulphidation-type quartz veins in the district average 3.5 m in thickness with portions up to 10 m thick, and extend from 150 m to over 11 km in strike length exposed in discontinuous outcrops. It is one of the world's largest epithermal vein districts, with an aggregate strike length of over 140 km of quartz veins. Exploration drilling has continued every year the mine has been in production, and Cerro Vanguardia has so far been able to replace and slightly expand its reserve base. At the end of 2002, proven and probable reserves stood at 9.5 Mt at 7.6 g/t Au and 106 g/t Ag. The mining rate is 0.9 Mt/y at a 3.0 g/t Au-equivalent cut-off grade, with low-grade material stockpiled for future heap leaching. Doré produced at Cerro Vanguardia is 10:1 Ag:Au and the metallurgy is simple. The high grades appear to be continuing at depth, and a small portion of the current mine plan is based on future underground mining which could expand in scope as drilling increases the resource base. The main producing pits are now approximately 80 m deep and the stripping ratio is about 15:1.

Coeur d'Alene Mines Corp. has extended the life of its small bonanza silver-gold Martha mine by one full year with the discovery of the R-4 Zone, a single, 28,000 t ore shoot containing epithermal quartz material averaging 4,450 g/t Ag and 3.7 g/t Au. The direct-shipping ore is bagged and transported by truck over 450 km to Coeur's Cerro Bayo mine and processing plant in neighbouring Chile's IX Region. Mina Martha produced 1.4 Moz of silver equivalent in 2002 and ore reserves stand at 5.3 Moz of contained silver equivalent. However, the cut-off grade necessary to ship the ore such a long distance is 1,000 g/t Ag. Coeur recently purchased Yamana's 10% net profits interest, which applies to properties located outside the Mina Martha area acquired from Yamana in 2001, and announced that it has increased its land position in the region.

The Manantial Espejo project is the second-largest epithermal, low-sulphidation vein district in the Deseado Massif. The 257 km² district, located about 100 km west and south of the region's biggest mine, Cerro Vanguardia, is 100%-controlled by a 50:50 joint venture between Silver Standard Resources and Pan American Silver Corp. Unlike Vanguardia, it carries no provincial override except for the federally-mandated after-cost royalty, which, in the case of Santa Cruz Province, will be 1% of the value of mine production. A 6,000 m drill programme planned for 2003 will raise total investment in the property to almost US\$20 million. It is designed, in part, to add a fourth target, the Melissa vein to the project's resource base together with the María Vein, the Concepción Vein, and the Karina/Unión Vein. The María Vein is one of the largest and most continuously mineralised quartz vein structures found to date in the Deseado Massif and contains 70% of the project's Ag/Au mineralisation in one place. A 2001 resource audit by Pincock, Allen and Holt reports measured and indicated reserves of 4.39 Mt at a grade of 4.5 g/t Au and 264 g/t Ag, plus inferred reserves of 1.59 Mt at 3.6 g/t Au and 258 g/t Ag. Exploitation is envisioned to be a combined open-pit and underground mining operation on distinct veins. An updated prefeasibility study is expected in 2003.

Minera Andes and joint-venture partner Mauricio Hochschild Compañía SAC have begun an underground ore-reserve exploration and development programme at the advanced stage Huevos Verdes high-grade gold-silver vein at the San José project (formerly called El Pluma- Cerro Saavedra) in the northwest part of the Deseado Massif. The goal of this work is to explore and define a gold-silver reserve base prior to a development and mining decision. Two 45-degree decline shafts are being advanced, and horizontal workings will be excavated on four levels for underground sampling to upgrade the resource into a mineable reserve. Snowden Mining Industry Consultants Inc. performed a 2002 resource estimate, based on approximately 60 drill holes and surface sampling, sufficient to categorise part of the resource as indicated and the rest inferred. For the Huevos Verdes and the Saavedra West areas, the combined total indicated resource was estimated to be 1.85 Mt at 214 g/t Ag and 2.1 g/t Au at a 50 g/t Ag cut-off grade. An additional 2.69 Mt of material averaging 253 g/t Ag and 2.5 g/t Au is classified as inferred. The project comprises 50,000 ha and, to date, four major parallel Au/Ag vein targets have been identified. A new 27 km all-weather gravel road has been built linking the project to the town of Las Heras via a new bridge constructed over the Río Deseado.

Immediately south of the San José project, Australian junior Oroplata Ltd has done further drilling on portions of the Eureka vein system on the Cerro Negro project, and is earning a percentage of the project from MIM Exploration. Encouraging Au/Ag results have been obtained on this epithermal low-sulphidation vein system believed to host an inferred resource of 6 Mt averaging 3.2 g/t Au.

Yamana Resources Inc. has entered into a three-way partnership to explore its properties in the eastern, gold-rich portion of the Deseado Massif. Compañía de Minas Buenaventura SAA and Mauricio Hochschild Compañía SAC, both experienced Peruvian miners, will team up to explore the Martinetas, La Paloma, and Microonda projects, plus nine newly-acquired properties in the region. Buenaventura will operate the joint venture which will trench and drill on epithermal quartz veins, concentrating on the highly prospective Coyote, Cerro Oro and Armadillo (formerly T-1) sectors at Martinetas which have potential for high-grade gold bonanza ore shoots. IAMGold continues to drill vein and breccia zone targets at its La Esperanza project. In a play on words designed to bring good luck to their ongoing exploration efforts, Tenke Mining has renamed the Bajo Pobre epithermal vein system north of Cerro Vanguardia the 'Alto Rico' prospect.

Companies that are currently actively exploring in Argentina include: Tenke Mining, Barrick, Rio Tinto, MIM Holdings, AngloGold, Anglo Base Metals, BHP Billiton, IMA Resources, Silver Standard, Coeur d'Alene Mines, Yamana Resources, IAMGold, Noranda, Mauricio Hochschild, Minera Andes, Meridian Gold, Mansfield Minerals, Golden Peaks, Patagonia Gold SA, Intrepid Minerals, Viceroy Exploration, Cardero Resources, Mena Resources, Exeter Resource Corporation, Oroplata Ltd and Aquiline Resources.

Non-metallics and construction minerals

The National Mining Sub-Secretariat estimates that 60% of Argentina's annual mineral production is metallics (US\$636 million), 30% is sand, gravel and ornamental stone (US\$327 million) and 10% is non-metallics (US\$110 million). There is a firm reactivation in all of these sectors.

Mica production for domestic consumption has resumed, and feldspar and quartz exports have increased. Dolomite and granite quarries around the population centre of Buenos Aires are reopening and there is new aluminium sulphate production in the cordillera of San Juan Province to satisfy increasing demand for water-purification projects in the capital region. Bentonite production is on the rise, with new investments in La Pampa Province and elsewhere. In Salta Province, a total of US\$1.2 million has been invested in three common salt projects. The Mineral Resource Institute of Germany has initiated an assistance programme for small producers of precious stones (amethyst) in Misiones Province. Gypsum wallboard continues to be produced in Mendoza Province by German company Yesos Ynauf.

The cement industry is exporting from two centres: in Patagonia, the port of Comodoro Rivadavia in Chubut exports cement to construction projects in southern Chile and specialty cement for oil and gas drilling to Ecuador; cement and derivative products from the large limestone belt extending from northern Mendoza to San Juan are being commercialised by several companies into the lime-poor metropolitan area of Santiago, Chile. However, rising costs for gas and electricity could negate the effect of devaluation and possibly curtail these growing exports of lime products.

Rio Tinto Borax, through its subsidiary Borax SA, has spent US\$3 million for borate plant improvements including a drying oven, refinery expansion and concentrator plant additions to process ore from its Tincalayu mine in northwest Argentina. A number of small borate mineral and boric acid producers also continue working in the region.

FMC Lithium continues to produce lithium chloride from its US\$137 million Fénix Project located at the Salar del Hombre Muerto in Catamarca Province, but full-scale production of lithium carbonate has been suspended since 2000 owing to price pressures by Chilean producers. The high-tech brine plant produces a lithium chloride concentrate that is further processed in Salta Province to produce lithium chloride, which so far has not been subjected to the same competitive pressure.

A proposed 250,000 cubic litres per day capacity natural gas pipeline to Pocitos in Salta Province is now being built by the government to promote borate and other non-metallics production in the region, and the governor recently announced the approval of an extension to FMC's Fénix Project. Australia-based Equity 1 Resources NL (formerly Argentina Diamonds) plans to utilise this pipeline for its Salar Rincón lithium-potassium-magnesium brine project, scheduled to go to final feasibility in 2003.

In southern Mendoza, near the border with Neuquén, Potasio Río Colorado SA (Minera TEA) holds the rights to a major potash (KCl) deposit in the Neuquén Basin. German company Kali und Saltz has terminated an option agreement with Grupo Minera TEA to re-evaluate a feasibility study done in the mid-1990s by Rio Tinto (CRA). The perennial rumour is that Rio Tinto will come back into the deal and this year is no exception. Also discovered by oil drilling in the Neuquén Basin, and with a feasibility study in place, is the Los Petisos sulphur project.

Infrastructure

The infrastructure section of the Argentina Annual Review is likely to grow in the coming years as the government focuses on improvements that will directly benefit mining. It cannot be overemphasised how important the Pacific Rim to Atlantic trade corridor linking Iquique with Sao Paulo will be to Argentina's future and to the future of mining in the northwest region. An interesting twist on free trade occurred this past year when slumping demand for copper resulted in surplus electricity from Chile's natural gas-fired Mejillones generating station being reversed through the new high tension line and sold in northwest Argentina while electricity generated at the Güemes station in Salta was exported eastward to Brazil, all made possible by Argentina's strong natural-gas production and pipeline network. This region is set to benefit from the upgrading of Mejillones into a 'mega-port' facility, as well as from a new cross-border mining agreement being negotiated with Bolivia.

An experimental programme of auto trains in the Puna region of Salta for transport of industrial minerals is also under way. Further south, Veladero will need electricity, and a projected 550 kV electric line from southern Mendoza to the mining projects in the Valle del Cura and farther north is still a possibility. El Teniente mine in Chile is scheduled to begin generating electricity using natural gas from Neuquén.

To close this year's Argentina review, the authors would like to quote from a recent Tenke Mining Corp. press release: "There has never been a better time to explore in Argentina. Many prime prospective areas remain virtually unexplored. Good contract terms are available with low initial investments, and the country has a capable and trained workforce. Tenke was able to take advantage of a lull in exploration activity by other mining companies and, in many cases, had first choice on the best properties. Now other companies, both senior and junior, are actively staking ground and starting exploration."

Exploration Expenditures and Drilling

Year	Expenditure (US\$ million)	Drilling (Metres)
1999	80	235,000
2000	140	230,000
2001	50	165,000
2002(p)	40	150,000
2003(e)	40	100,000

Source: Argentina Mining Sub-Secretariat.
(p) provisional, (e) estimated.

Value of Argentina's Mineral Exports (US\$ million)

1999	2000	2001	2002(p)	2003(e)
775	711	786	849	920

Source: Argentina Mining Sub-Secretariat.
(e) estimated

Mineral Production

Commodity	Units	2000	2001	2002(p)	2003(e)
Gold	kg	25,955	30,630	32,486	28,444
Copper	t	145,197	191,667	218,100	205,242
Silver	kg	78,271	152,802	113,027	138,766
Zinc	t	34,858	39,703	36,358	40,669
Lead	t	14,115	12,334	12,931	13,514
Borate	t	512,624	633,520	509,630	550,000
Bentonite	t	123,092	135,450	88,685	105,000
Gypsum	t	559,257	492,462	445,461	500,000
Lithium carbonate	t	873	0	906	1,100
Lithium chloride	t	1,824	4,512	4,729	4,320

Source: Argentina Mining Sub-Secretariat. (p) provisional, (e) estimated.