

## CHILE

*By Simon H.C. Tarbutt*

**A**long with copper hitting its lowest price in five years, US\$0.71c/lb on the LME, the lack of response in the overall economy was blamed alternately on the international situation and the lack of flexibility to manoeuvre on the home front. GDP decreased from US\$66.5 to US\$66.4 billion, while total exports decreased by 0.7% to US\$18.3 billion; mining exports, however, fell by 8.5% to US\$7.3 billion, with copper contributing US\$6.3 billion for a fall of 7%. Inflation stood at 2.8%, against 2.6% in 2001.

A ten-year touchstone on the population was provided by the country-wide census. The total population increased by 13% to 15,12 million against 13.35 million in 1992; within this the over-sixty population increased from 9.8% to 11.4%, and the under-fifteens decreased from 29.4% to 25.7%. The number of school years attended increased from an average of 7.5 to 8.5 years, and professional and technical education increased from 3.8% to 7.5% of the population. The standard unemployment figure stood at 7.6%, an improvement on the 8.3% for 2001 in both percentage and in the number of people losing jobs, though the first-time employment seekers showed a heavy concentration in the poorest sections of the community, standing at 41%.

### **Legislation and politics**

The labour reform law, which came into effect in December 2001, is estimated to be adding an additional 6.75% to the payroll, due to such items as strict regulation on working hours, restriction of overtime to immediate emergencies, and two specifically Sundays a month rest; with the four-days-on, four-days-off, combined with 12-hour shift schedules at the remotely-located mines, even State companies have found themselves in trouble with the law. Substantial flexibility has been removed, which in the present times of low activity and high unemployment has raised many voices on all sides, to the point that the government is negotiating a proposal to introduce some 'adaptability' modifications.

Codelco's El Teniente mine has been classified as a 'heavy work' area, being an underground mine. This determination of heavy physical labour or mental stress can be declared due to such aspects as extreme temperatures, habitual night shift, underground or sea employment, as well as working at an elevation of more than 4,000 m. The consequence is an additional contribution of 1 or 2% to the individual pension funds, paid equally by both parties, against the employees 'premature aging'; however the employee is not obliged to retire at an earlier age, nor does a company have any recourse to insist on retirement.

The unemployment insurance law came into effect in October, under the administration of a private consortium of pension funds, at a company cost of 2.4% on an individual's payroll, who makes a 0.6% contribution; the State

subscribes a lump sum of 225,792 Monthly Tax Units per year (approx. US\$9 million in January, 2003). Generally, the law has been well received throughout the country.

A matter of considerable discussion has been the tax situation of mining companies. Attention was focused by the sale of the Disputada properties by ExxonMobil, during which it was revealed that no income tax had been paid on the 24-year operation, and this after fully audited and recognised accounting demonstrating investments over 18 of those years. Arguments are still flowing on modification to the tax structure and the introduction of royalty charges. The government has stated that changing the rules for mining companies is not in its programme, and the local miners point out that the playing fields are absolutely level by law, so any modifications would have to apply to them as well; a Senate committee is being set up to study the matter, especially regarding new projects.

On the other side of the coin, in August the private pension fund companies gained the legal structure to offer varying investment combinations that an individual can select and vary over time. There are five funds which can be combined, from 'A' with a maximum of 80% in stocks to 'E' which holds only guaranteed time deposits; during the initial conversion, rules were clearly set out for the 6.7 million members as to which funds could be selected by those members close to retirement.

On the political front there were no elections nor preparations for them, the next being the municipal elections in October, 2004. The relations between the parties within both the governing and opposition coalitions experienced their usual conflicts, remaining internal and not affecting the overall governance of the country due to the binominal constitutional system. General Pinochet was declared unfit to be able to defend himself, so all court proceedings have been dropped against him and he has resigned from the Senate; though under careful medical attention he is living in peaceful retirement with his family.

Free trade agreements have been signed with the European Union, Canada, the US and with South Korea. The EU agreement went into effect in February 2002, and the Canadian one will be exercised as of January 2003. The US one still requires ratification by both parliaments, as does the South Korean agreement signed in February 2003.

### **Exploration**

The registration of exploration claims maintained by the National Geology and Mining Service (Sernageomin), shows that the number of valid claims in 2002 increased from 18,220 to 19,615; reflected by the Fraser Institute in December in its Annual Survey of Mining Companies, that classified Chile as the most favourable country of 47 jurisdictions for mineral exploration; awarding the country the maximum of 100 on the 'Mineral Potential Index' and 85 on the 'Policy Potential Index'.

The iron ore-copper-gold (IOCG) belt, basically the coastal area straddling Regions III and IV, is receiving renewed attention. Latin American Copper, quoted on the London OFEX, has been in the area a few years. At the start of 2002, the company dropped Corona del Cobre in the IOCG belt, the holding charges being too high; a drilling programme was completed on Cerro Sur in Region III, under an agreement with the owners BHP Billiton to earn a 70% interest.

In Region II, LAC acquired an option from Enami to purchase the Lilian prospect, previously evaluated as a resource containing 4.27 Mt averaging 0.86% Cu (oxide), by spending US\$700,000 over four years and US\$2 million after the seventh year. The El Teno grass roots porphyry copper prospect, Region VII, was optioned for escalating payments of US\$195,000 in shares, US\$17,500 in cash and US\$975,000 in work commitments over five years.

Far West Mining of Vancouver entered into an agreement with BHP Billiton to use the latter's Falcon gravity gradiometer technology for an airborne survey of four prospects in the area; the agreement involves earn-in and back-in percentages by the respective parties at various levels of definition of the prospects. Three targets have been identified for drilling in 2003, subject to financing.

In the same area, Minera IPBX Ltda, the Chilean subsidiary of International PBX Ventures Ltd, has entered into an option agreement on the Tabaco copper-gold-silver property, an acquisition agreement of the Zulema gold-copper property, and has expanded its copper-gold Sierra Pintada claims.

In March, American Canyon Mining, a private Chilean company, submitted a US\$300,000 environmental declaration for the exploration of its San Ramon and Algarrobo copper-gold-cobalt prospects in the north of the IOCG belt. In mid-year Solomon Resources Ltd of Vancouver signed an option agreement to earn up to 80% in San Ramon by incurring US\$6 million expenditure on the properties over three years. In October, Solomon exercised its right to 70% of the property.

SAMEX Mining Corp. of Canada has also been inspecting prospects in the area.

Atna Resources Ltd of Toronto, through its Chilean subsidiary Minera Atna Chile Ltda, had an agreement with Apex Silver Mines of Denver under which the latter funded an initial drilling programme on the historic Chañarcillo silver property in Region III. Although pervasive values of silver and zinc were found, Apex dropped its option in October after evaluating that the property would not support a bulk tonnage operation; Atna is reviewing the information to decide on future actions. On the Cerro Negro copper prospect in Region III, after some drilling and extensive metallurgical testing, the option with Enami was dropped early in 2003 due to financial conditions in the agreement. Atna is maintaining its 100%-owned Celeste concessions that surround Cerro Negro.

Nittetsu Mining Co. Ltd, a Japanese resource company, has identified a number of prospects by using data from the high-performance sensor ASTER (Advanced Space-borne Thermal Emission and Reflection Radiometer), and in December presented an environmental declaration for a US\$180,000 exploration programme for the gold-copper Furano concession in Region I.

Silver Standard Resources of Vancouver continued with the evaluation of the Challacollo silver property in Region I, where in late 2001 it had acquired an option to purchase 100% of the old operation for US\$1.5 million in staged cash payments over two years; The property is subject to an existing 2% royalty as well as a further 2% royalty to the property vendors that can be purchased for US\$1.5 million at any time. The company is showing an indicated resource of 1.52 Mt containing 6.8 oz/t Ag and an inferred resource of 5.19 Mt with 7.1 oz/t Ag.

Early in 2002, Antofagasta Minerals, the mining division of Antofagasta plc of London, completed a drilling programme on its Esperanza copper project, 4 km from its El Tesoro mine in Region II. The company is indicating a total mineable reserve of 73 Mt at 0.41% oxide Cu and 295 Mt of sulphide averaging 0.66% Cu and 0.31 g/t Au. In September a plan to build a decline into the orebody was announced, which would take 18 months to complete.

Codelco has completed basic exploration of the Toki deposit, Region II, defining limits for an inferred resource of 6.2 Mt of contained copper; Quetena and Vicky prospects were identified for further exploration, both in Region II. A number of exploration claims have been discarded from the extensive holdings. Nevertheless historically, initial exploration had resulted in consolidation to a mining concession, even if the prospect was of no economic interest to Codelco; by law these cannot be discarded and have to be transferred to Enami. Exploration efforts abroad, through joint venture agreements, are taking shape in Mexico, Brazil and Peru.

Expatriate Resources has been active in Region II. Through its wholly-owned Minera Latina SA it has acquired from Falconbridge the Chug Chug prospect (close to its Gabriela claims), Cerro Ocre and Payo; these are in exchange for Expatriate shares and 50:50 buy-back options. An agreement has been reached with BHP Billiton Chile to explore the Gabriela prospect. The other wholly-owned company, StrataGold Corp., has received the Islena-Yessica Au-Ag-Cu prospect. Extensive exploration is anticipated for 2003.

In February, Aldershot Resources of Vancouver reached a settlement with the landowners over its Tierra de Oro gold exploration property in Region III. The company is carrying out a US\$120,000 drilling and IP survey programme, to evaluate the initial 40% option.

Kinross Gold announced at the end of the year that a drilling programme was to be carried out at its Refugio gold mine in Region III; the mine has been in residual leach mode since mid 2001, and a decision to restart operations is under periodic review.

Metallica Resources Inc., registered in Toronto, continued the exploration of its El Morro prospect in Region III, increasing the indicated resource to 465 Mt containing 0.61% Cu and 0.50 g/t Au at a 0.4% Cu cut-off. Noranda Chile Ltda is executing the exploration and can earn a 70% interest in the property by spending US\$10 million on exploration and development over six years from September 1999, as well as completing a feasibility study by 2007 and paying an additional US\$10 million to Metallica in 2005; this payment was made in 2001 and, although the agreement is in good standing, Noranda announced that exploration would be on hold during 2003.

Mandalay Resources Corp. of Vancouver has been active on its La Quebrada and neighbouring El Puclaro copper-silver properties in Region IV, the latter with favourable channel sampling, and the former looking for financing for a phase 1 drilling programme to complement previous surface and limited drilling expeditions by other companies.

South American Gold and Copper Co. of Nova Scotia renewed exploration on its Pimentón gold property in Region V, encountering a new breccia pipe structure. Towards the end of the year an announcement was made that a prefeasibility study had been completed to restart operations at 2,000 t/mth. A scout-drilling programme was carried out on its Meseta copper claim in Region III; the project was dropped, and attention concentrated on the other gold prospect Antena and the lime prospect Catedral, as well as renewed emphasis on financing the Cal Norte lime plant, Region IV, a 60:40 venture with Compañía Minera Quelón.

Corfo (the state production development corporation) requested bids on the Estancia Invierno coal prospect on the Isla Riesco in Region XII. This was awarded to Minera Otway, a society formed equally by Ingeniería del Sur (Ingesur, related to the coal miner Carbonífera Catamutún) and Ingeniería Civil Vicente; confirmation exploration has started; previous resource evaluations demonstrate 670 Mt of sub-bituminous (4,300 to 5,500 kcal/kg) coal.

### **Technical development**

One central theme during the year has been efforts by all parties to set in motion the objective of forming a mining cluster in northern Chile centred on Antofagasta; notable the development of the cities of Antofagasta and Iquique over the past two decades has been notable, with the bigger mining operations providing the base for decentralisation to these cities. Further development will not only provide mutual benefits, but also form the base for continued activity when the mines eventually close down.

The purchase by Anglo American of ExxonMobil's Disputada de las Condes operations was closed finally in November after an initial award in May. Legally, the companies could have carried out the transaction offshore, thus Exxon would not have had to pay capital gains tax at least in Chile which was not acceptable, especially as Disputada had paid no income tax as explained previously; a settlement was reached, the tax and stamp duty bill coming to US\$39.3 million on a cash sale value of US\$1,300 million. There will be

additional payments over the next five years, depending on the price of copper, up to a maximum of US\$1.00/lb. Another difficulty was that Enami had established a 49% buy-back option in the original 1978 sale; due to company restructuring over the years this option had not been included in the recent transaction, mutual lawsuits were initiated but eventually withdrawn after an agreement was reached to recognise the option up to the original date of 2008. The option can be exercised every three years as of December 31, 2001, on a total value of US\$1,873 million revalued at 10% per year. The properties involved are the 180,000 t/y Los Bronces open-pit copper mine and plants in the Metropolitan Region; the 70,000 t/y El Soldado open pit and underground copper mine with its associated plants, as well as the 220,000 t/y Los Chagres smelter, both in Region V.

The expansion of Antofagasta Minerals' Pelambres mine, in Region IV, from 114,000 to 120,000 t/d has been put on hold until market conditions can absorb the increased production; a US\$170 million investment in a new tailings dam is proceeding, the two dams will have enough capacity and safeguards to handle the eventual expanded production for some 50 years.

Alliance Copper Ltd, a 50:50 joint venture between BHP Billiton and Codelco to test the commercial viability for the former's bioleaching technology BioCOP®, is constructing a pilot plant at Chuquicamata in Region II for US\$60 million, to leach sulphide concentrates containing arsenic; 20,000 t/y of cathodes will be electrowon at existing facilities. A preliminary agreement has also been reached to process with this technology the concentrates that will result from Mansa Mina for 100,000 t/y of cathodes.

Codelco and Nippon Mining & Metals launched Biosigma, which is a 67:33 joint project to research and develop bioleaching technology. Scientists worldwide were invited to submit research proposals; in December it was announced that four specialist consortia had been selected, three Chilean and one Japanese, for the initial US\$1.0 million funding.

The Spence project in Region II of Minera Riochilex, a subsidiary of BHP Billiton, finished the year with the approval of its EIS, for the execution of a US\$800 million project to produce 200,000 t/y of cathode copper; the earliest production date would be 2005.

The Minera Can-Can SA subsidiary completed, in November, the environmental declaration necessary to excavate two tunnels to gain underground access to the Choquelimpie gold deposit in Region I, previously mined by Shell as an open pit. The tunnels will supply ore for metallurgical testing of the 1.5 Mt potential resource containing 14 g/t Au equivalent (incl. Ag and Cu); two concentrates are expected. This mine is located in a natural reserve at 4,650 m above sea-level.

Potential country-wide electric supply and/or cost problems still persist. The Greater North Interconnected System (SING) uses thermal (oil and coal based)-generated power, and having excess capacity the costs are very competitive for most of the mining community; the Central System (SIC),

supplying 90% of the population relies 60% on hydroelectric power. Even so, the-freely negotiated rates are some 50% higher. A 'short' law, supposedly to clarify the more immediate aspects, has been in negotiation for three years; part of this law would permit the State to bid the interconnection of the two systems, which has not happened on a commercial basis as other options are more economic. Should the interconnection be executed, the regulated rates to the general population in the north will go up. Also, eventually, the renewal of contracts between companies will see cost increases in the negotiated rates.

The reorganisation of Codelco got under way with the appointment of a general manager for Codelco Norte (Chuquicamata and Radomiro Tomic), and the reduction of corporate vice presidents from eight to five – Strategy and Control, Human Development and Finance, Human Resources and Development, Communications and Sustainable Development, and Operations. Also it will be necessary for each business unit to produce balance sheets and profit and loss accounts to promote overall efficiency in results, instead of concentrating on only costs. Problems arose at Codelco Norte with the bidding on the construction of 2,500 houses in the town of Calama, due to changes in specifications after bidding documents were released causing a large disparity between approved expenditure and the final bids; the general manager resigned and has been replaced with a sixth corporate vice president.

As a means of refinancing debt, Codelco successfully and for the first time ever, issued ten year bonds at 4.65% on the local market in November, for an equivalent value of US\$164 million.

Enami has invited bids on various medium-sized copper properties, the sulphide Delta property in Region IV, the oxide property Canchero in Region II, and shortly the Camarones oxide property in Region I should be available, once final details on the release of the area by the army are completed.

Enami's debts still stand at some US\$480 million, and US\$240 million of this sum relates to environmental measures at the smelters which have been financed by commercial loans on the instructions of Enami's owner, the State; a further US\$164 million relates to 'advance profits' withdrawn by the State to repay Treasury-supplied mining promotion funds (part of Enami's fundamental function), and the rest to ever-accumulating interest payments. One solution, to resolve half the debt, and discussed for some two years, has been to sell the major asset, the Ventanas smelter and refinery (323,000 t/y copper cathode), to Codelco; after much protest from unions and other organisations, in December it was finally agreed that a protocol would be signed and the project presented to congress, a legal requirement for both state companies. At the same time, the government agreed that the State would be guarantor for US\$220 million of renegotiated short-term debt.

Falcon de Chile SCM, formed by Chilean professionals in association with the Marshall group of South Africa who are the majority shareholders, has presented an environmental impact study to construct La Coruña iodine

project in Region I. Phase I will require the investment of US\$12 million to produce 1,600 t/y of iodine from reserves of 80 Mt averaging 500 ppm (37,000 t iodine). The mining will be contracted.

General Minerals Corp. of Denver is actively looking for an additional partner and continues studies on the 51%-owned Vizcachitas copper-molybdenum property in Region V. The company has declared a resource estimate of 283 Mt averaging 0.60% Cu, including a defined secondary enrichment zone of 37 Mt at 0.85%; recent metallurgical testing indicates the possibility of leaching both primary and secondary ores.

The 2½ year case brought against Fluor Daniel by the joint owners of the Maricunga gold mine – Bema Gold and Kinross Gold – for faulty construction activities, was settled for a sum of US\$20 million plus interest in favour of the owners, who received US\$24 million in September.

SQH, which controls Soc. Sociedad Química y Minera de Chile SA (SQM), a complex of producers in Regions I & II and worldwide commercialisers of fertilisers, iodine and lithium, reached an agreement with Norsk Hydro of Norway to form a new company, Inversiones SQNH, in which Norsk holds 49%. Later in the year, Potash Corp. of Saskatchewan increased its holdings in SQM to 20%, through a public purchase offer, similar to the stake held by SQNH. In mid-year, SQM informed the US Securities and Exchange Commission that through 2004 it plans capital expenditures of US\$180 million directed towards new products, increased capacities, equipment replacement and cost cutting.

### **Sustainable development**

A number of very different items have come together that demonstrate that the mining community is achieving better communication with its neighbours and stakeholders. The following is a selection, to demonstrate the scope of activities, especially in education, that are being pursued by mining companies of all sizes.

The year was not without its accidents; a concentrate and a tailing-line breakage, a couple of sulphuric acid spills, and an incident involving damage to agricultural plants. Legal actions and fines were imposed accordingly. However, there were no long-lasting effects and community relations have not been affected because of the combined efforts of stakeholders, authorities, mining companies and their employees, to understand better what mining means and the processes involved.

Over some 50 years in the late 19th, early 20th centuries, 'salitre' or fertiliser mining in Regions I and II, was the mainstay of the Chilean economy; with bad and good memories this is an integral part of the history of Chile. The Corporación Museo del Salitre was formed a couple of years ago to preserve and promote the ex-salitreras Humberstone and Santa Laura; it has five years to develop and implement a full programme. With the help of Minera Collahuasi to purchase the infrastructure and of SQM to establish an on-site operating structure, there has been a start on restoration and a museum; a

number of visitors were received over the recent summer period, and a presentation has been made for World Heritage recognition.

Enaex, an explosives company which also contracts with various mines for blasting operations, has developed a process for receiving and filtering used engine and crankcase oils, then recycling them in the preparation of anfo. Care has to be taken in the 'clean' collection of these oils, but the savings in fuel oil for the same blasting efficiency makes it worthwhile economically and environmentally.

Minera Pelambres, Region IV, has set up a foundation (Fundación Minera Los Pelambres) that gives a formal structure to the ongoing efforts to assist and guide in the application of up-to-date technology in the local agricultural and fishing industries; included is a scholarship programme for training local technicians. Pelambres is also on the Watch Committee for the Choapa River, where one of the combined aims is education in the better and more efficient use of the water.

BHP Billiton's world policy is to dedicate 1% of its pre-tax profits to local development funds. With regard to the Cerro Colorado operation in Region I, the town of La Tirana has set up a 'negotiating table' or committee of stakeholders to decide amongst themselves the priorities and execution of their own projects. The Foundation from Escondida, funded the construction of a school and facilities in one of the poorer areas of Antofagasta, where there had been no infrastructure for a group of dedicated teachers and an enterprising community. The mining company actively supports a competitive quality-of-life fund, where the employees propose projects for their own communities; to date out of 2,600 employees there have been 400 participants. Also, amongst other items, the flamingos at the Salar de Punta Negra – one of the sources for water at an altitude of over 4,000 m – after years of study, are assured their water-protected nesting habit during periods of drought, by the installation of wells to maintain critical levels.

Barrick Chile Ltda's El Indio gold mine went into its US\$45 million four-year closure operation during 2002. Waste dumps are being contoured, and leach heaps flushed for cyanide which is treated before water release; buildings are being removed and the Rio Malo is being channelled through the dumps area and arsenic levels from drainage reduced at least to background levels by cascading to cause precipitation by reaction with iron.

At the start of the year, Sernageomin, in conjunction with the Ministry of Mines and the government's international co-operation agency, signed an agreement to draw up a register of all mining activity and to determine the level of risk associated with installations. In December, the Mining Ministry and the Consejo Minero (the private council representing the large-scale mining community) presented their combined two-year preparation of a framework agreement on clean production. The agreement covers six areas: the potential generation of acid water; closure of mines; efficient use of energy and of water; industrial liquid and solid wastes. Many other public entities participated.

## Production

The price of copper was the talking point throughout the year. The reference price for the fiscal period 2003 - 2012 was dropped from US\$0.90 to US\$0.88/lb; this is determined by the Treasury, after wide consultation. By the middle of the year producer projections were showing a range of US\$0.70–0.74/lb for 2002, with US\$0.74 –0.78/lb for 2003. The final LME price of US\$0.71/lb for the year, has not lowered expectations for a price approaching US\$0.80/lb in 2003.

In an effort to stabilise the price of copper, BHP Billiton through Escondida, and Codelco overall, both lowered production in real terms from their original estimates. BHP Billiton reduced output by 160,000 t (November 2001 to December 2002) and Codelco by 100,000 t. Escondida has extended this flexible cut-off approach into 2003, where, subject to a review in June and combined with heavy maintenance scheduling at the older Los Colorados concentrator, its anticipated production of 1.25 Mt will be reduced by 200,000 t. Codelco has taken a different approach, resuming the traditional cut-off method for reasons not purely economic, and storing 200,000 t of its anticipated production of 1.6 Mt in its own warehouses until the market justifies its release for sale. Other copper producers are observing the effect of these approaches, especially Anglo American and Noranda who maintain their international copper offices in Santiago.

Antofagasta's Michilla mine, produces 50,000 t/y of copper cathode, and earned a reprieve at the beginning of the year by getting cash costs down below US\$0.60/lb, and development plans involving its patented Cuprochlor process are being evaluated. The expansion of Pelambres from 120,000 to 175,000 t/d for an additional 100,000 t/y of copper, remains under review. In 2002, the mine produced 324,600 t.

At Quebrada Blanca in Region I, Aur Resources completed its US\$20 million run-of-mine (ROM) leaching project to raise production from 75,000 t to 80,000 t/y of cathodes. Production in 2002, however, was 4,200 t below forecast, mainly due to severe winter conditions at the 4,400 m altitude mine.

BHP Billiton operates two mines. Cerro Colorado received approval from the environmental authorities for a US\$41 million expansion from 100,000 t to 130,000 t/y of cathode copper, by the retreatment of tailings and various infrastructure improvements. At Escondida the Phase IV expansion construction was completed and the ramp up to 237,500 t/d was effected by April of 2003. This will compensate for falling grades, and, for the first five years, annual copper production will increase by 400,000 t to 1.25 Mt. The feasibility study for the US\$535 million Escondida Norte open pit, 5 km to the north, is under way. A prefeasibility study for the low-grade sulphide dump leaching project, valued at US\$435 million, has also been completed.

Principal expenditures for Codelco were at El Teniente and Chuquicamata Divisions. At El Teniente the Programme for the Development of El Teniente (PDT) expansion project advanced to 76% completion with US\$636 million

authorised out of the total US\$736 million. Production will be increased from 380,000 t to 500,000 t/y by 2005; with parallel environmental projects, the total expenditure will approach US\$1.1 billion. At Chuquicamata a US\$12 million contract was signed with SNC-Lavalin of Canada and Paul Wurth of Luxembourg in November, though preliminary work had started in June; the project is expected to take 33 to 35 months to change to the Falconbridge permanent cathode process, as well as other fine-tuning measures. This is part of an US\$195 million project to raise production from 683,000 t to 1.08 Mt/y of copper. The first-stage completion to 855,000 t is expected during 2005.

The US\$506 million plant expansion of Minera Doña Ines de Collahuasi was authorised towards the end of the year and principal contracts awarded, with completion expected for June 2004; the concentrator will be expanded from 60,000 t to 110,000 t/d to compensate expected lower grades resulting from the US\$148 million transfer of ore production from Ujina to the Rosario pit, already under way for completion in 2004. Production in 2002 was 434,000 t, including 61,000 in cathodes. With the expansion, this is anticipated to increase to close to 500,000 t for a few years, before falling back to the same levels.

Noranda's Lomas Bayas mine completed a US\$20 million project to expand the SX section and to develop the ROM low-grade heap leach, expected to be in production in 2003; a further environmental impact statement (EIS) for US\$15 million to maintain cathode production at 60,000 t/y was presented. The US\$170 million expansion of the Altonorte copper smelter, outside Antofagasta, was completed early in 2003 doubling concentrate capacity from 400,000 t to 820,000 t/y and copper production to 290,000 t/y. At the US\$2.75 billion Alumysa project (a proposed 440,000 t/y aluminium processing facility in Region XI), discussions and negotiations continued of the environmental study presented in 2001.

The medium-and small-scale producers, including a number of non-copper operations were especially active during the year, as demonstrated by the following examples.

In January, at the Aguas Blancas iodine property, Region II, the builder and operator, Minera ACF of Chile, achieved 2 t/d production which completed the first phase of its 50% earn-in option from the owners Atacama Minerals of Vancouver; the property was officially opened in April. Phase II got under way with sodium sulphate due for production in early 2003.

Minera Atacama Kozan (Nittetsu 60% and Inverraz 40%) completed the construction of its US\$60 million underground mine and flotation plant and went into operation at the beginning of 2003. Production is expected to be 90,000 t/y of copper.

Coeur d'Alene Mines (CDE), having wished to sell up two years ago, has acquired new assets and is looking at expansions; while the gold-silver Petorca property in Region V was sold back to part of the Callejas family, the

silver-gold Cerro Bayo property in Region XI has gone from strength to strength. A US\$6 million development programme brought the contracted mine operation into production in April, CDE processing the ore in its nearby Fachinal plant; reserves have been increased and in October an EIS was submitted to convert to open-pit operations on a new vein system. In March, CDE reached an agreement with Yamana to acquire the Martha silver mine, 430 km to the East of Cerro Bayo in Argentina; in April shipping ore to Cerro Bayo started at 100 t/d.

Standard Uno is a travertine marble miner in Region II, promoted by Chilean professionals who exchanged 99% with Standard Gold of France to bring the project to production. The company is presently supplying some 50% of the local market at 100 m<sup>3</sup>/mth, and dispatching cut blocks to Italy for evaluation against a US\$6 million expansion project to produce some 40,000 m<sup>2</sup>/mth of slabs in four qualities from 1,500 m<sup>3</sup>/mth of marble.

Flores de los Andes is a vertically-integrated lapis lazuli company with its underground mechanised mine in Region IV. Some 600 t/y are processed into household fixtures, such as tiles and knobs, industrial ultra-marine pigment (acid and alkali resistant) and high-quality pigment. Some 90% of the products from this industrialised process are exported.

Arno de los Muermos is a copper project in Region VII and is preparing its environmental declaration to open a 150 t/d underground mine averaging 3% Cu and 3 g/t Au.

Also in Region VII, Lloimavida, a 1,000 t/mth zeolite project is getting under way, with in-country sales assured. Compania Cesar Formas, actively engaged in other organic products, is actively negotiating with export clients.

Most of the larger companies are now fully approved for ISO 14000, or in the process of qualifying. Along with this, mining proved again to be the safest occupation in the country, with at an accident rate of 4.23%, compared with a country-wide figure of 7.73%.

Tables next page.

**Table 1: Mineral Production ('000 t except where stated)**

	2001	2002
Copper	4,766	4,620
Molybdenum	33	29
Gold (t)	43	39
Silver (t)	1,349	1,210
Iron Ore	5,437	7,269
Nitrates	1,072	1,174
Iodine	11	12
Sodium Chloride	5,989	3,503
Lithium Carbonate	31	35
Lead	1	3
Zinc	33	36

Source: Sernageomin

**Table 2: Mine Production**

Mines	Copper (t)		Gold (kg)		Silver (kg)	
	2001	2002	2001	2002	2001	2002
<b>COPPER</b>						
Large scale	4,409,929	4,225,840	10,923	12,181	653,509	556,929
Medium scale	292,218	353,913	1,898	2,204	25,652	27,626
Small scale	39,974	34,652	403	350	8,534	7,344
<b>GOLD</b>						
Large scale	22,534	4,726	9,119	6,762	398,896	230,739
Medium scale	706	28	18,065	16,253	255,453	382,149
Small scale	701	628	2,168	879	2,576	1,937
<b>SILVER</b>						
Large scale	-	-	-	-	-	-
Medium scale	-	-	-	-	-	-
Small scale	-	-	6	7	584	796
<b>ZINC/LEAD</b>						
Large scale	-	-	-	-	-	-
Medium scale	-	-	91	52	3,463	2,952
Small scale	-	-	-	-	-	-
<b>TOTAL</b>	<b>4,766,062</b>	<b>4,619,787</b>	<b>42,673</b>	<b>38,688</b>	<b>1,348,667</b>	<b>1,210,473</b>

Source: Sernageomin