

Chilean Mining

The world's largest copper producer and a highly developed services industry make Chile a key mining country in the region.

A REPORT BY GBR FOR E&MJ

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This report was researched and compiled by Global Business Reports (www.gbreports.com) for Engineering & Mining Journal. Editorial was researched and written by Alfonso Tejerina (alfonso@gbreports.com), Clotilde Bonetto Gandolfi (clotilde@gbreports.com), Miyese Ozcan (miyese@gbreports.com) and Rory Sheldon (rory@gbreports.com). (Photo courtesy of EDM – Exploration Drill Masters)

Chile: The Strength of the Global Leader

Enjoying political stability unmatched in the region, the world's largest copper producer has set an example in the development of its mining sector and related industries



Economies of scale enable Chilean copper producers, such as Escondida (shown here) to hold costs down. (Photo courtesy of ABB)

Chile has long been considered one of the most forward-thinking and progressive countries in Latin America. Displaying a business-friendly environment and some massive copper deposits, the country is comfortably positioned as the planet's giant in the red metal, with an annual output over four times as big as the second nation in the ranking, neighboring Peru.

After 2007's annual production of 5.5 million metric tons (mt), Chile's production for 2008 will be around 5.7 million mt and the government hopes that the barrier of 6 million mt will be breached in 2009. Taking into consideration the high copper prices of the last couple of years, one can imagine the impact of such figures in a country with less than 17 million people. Copper accounts for more than one fifth of the gross domestic product (GDP).

And although it doesn't hit the headlines that often, Chile also excels in very profitable production of molybdenum, around 45,000 mt last year (21% of the world's total) and has been substantially increasing its silver production to reach 1,936 mt in 2007, placing itself as the

world's No. 4 silver producer after Peru, Mexico and China.

What's Next?

One of the typical questions posed with regard to the Chilean mining sector refers to its potential for future growth. As is the case in many large operations, copper grades are decreasing and increased throughputs are needed to maintain the same amount of copper output. A similar situation applies to molybdenum, production of which is actually expected to decrease in the country by approximately 10% in 2008.

Due to its political stability and its tradition for mining, the country has been more actively explored than other Latin American nations such as Peru, which results in a general feeling, both inside and outside of Chile, that the industry therein has reached a level of maturity. "Chile, because of its mining history, has already attracted many investments over the past decades. Other countries are just starting to do so, therefore it is normal that they bring in more investors today," said José Pablo Arellano, president and CEO of state-owned National

Copper Corporation (Codelco), the world's largest producer company-wise.

Yet, while many industry players agree on this point, they also underline that the potential to keep growing is still very big; it might not translate into striking growth rates, but in absolute terms, every bit of expansion in Chile is significant by industry standards.

"We are not worried about the reserves," said Alberto Salas, vice president of the National Society of Mining (Sonami), an organization grouping most mining companies active in the country. "Today Chile has much larger proven reserves than in the 1980s, even if much has been extracted over the years. In parallel to that, technologies have improved, therefore it is viable to produce minerals from lower-grade deposits."

If there will be more discoveries the size of Escondida, meaning "hidden" in Spanish, or if exploration will concentrate on brownfield activities to expand the existing deposits is another question. BHP Billiton, Escondida's operator, will invest \$230 million in the period 2009-11 to explore new reserves in the same area. Alejandro Vio Grossi, national director of the government's geological body, Sernageomin, said that: "Traditionally, exploration in Chile has targeted big deposits. Now, according to many experts, those will be increasingly difficult to find, therefore the potential will lie in small and medium-sized deposits."

In other words, ore bodies that might not be very attractive for the world's largest mining operators, but that can offer good potential for medium-sized mining companies; a market overshadowed by the majors but of great importance in Chile.

Beyond Big Mining

According to Sonami's statistics, small and medium sized companies (processing up to 8,000 mt/d) contributed nearly \$3 billion to the country's exports in 2007. As Salas pointed out: "Exports from small and medium-sized companies amounted to an average \$1.2 billion annually between 2000 and 2007, even

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if copper prices were very low in part of that period. Against the common perception of the public, small and medium-tier copper producers are much more important than the saltpetre or the iron ore industries in Chile."

Sonami includes 45 companies of major and medium status, and a further 3,000 small mining organizations. It is small and medium sized companies that have a proportionally greater impact in employment, Salas insists, as economies of scale and automation are increasingly important in large operations.

Big or small, mining has definitely been Chile's growth driver or, as it is often said locally, the country's "salary" or "central pillar." However, that statement is constantly offset by a lack of mining awareness of the average Chilean citizen, especially among those not related to the industry. Even if mining only directly employs 4% of the Chilean population according to official figures, the industry is struggling to find enough people within the remaining pool of workers to support its growth. This is applicable to both mining companies and their service providers.

"The mining sector offers very good salaries in Chile, as compared to other industries," said Verónica Baraona, vice minister of mining. "But that doesn't mean that we are able to attract enough people, as there is a lack of professionals worldwide. It is a big area of concern. We need to educate Chilean youths in the importance that mining has for Chile, and awake their professional interest."

Francisco Costabal, president of the Mining Council, an association defending the interests of 18 major operations, agrees. "In the mining region we are very well known, the level of understanding about our contribution is high. But in the

south, where there is no mining, people do not have a clear picture about the sector." Yet Costabal is confident that the industry will be able to find enough talent to continue growing. "The career possibilities are phenomenal in the mining sector," Costabal said. "We are seeing some migration to other countries such as Australia or the United States, but in a globalized market this is natural. To keep the best skills, companies need to become an employer of choice, and the industry is working very strongly in that direction."

Other Challenges

Strong opposition to mining developments from indigenous populations is not an issue in Chile, where many operations are located in desert areas in the north. However, the industry suffers from the scarcity of water and from an energy crisis that has only started to be tackled recently.

With regards to water, the sector seems to be heading toward the use of seawater, desalinated or not, as the most adequate (though costly) solution. BHP, for example, will build a second desalination plant at Escondida, while Antofagasta Minerals is also planning a 145-km pipeline to pump water from the sea to the future Esperanza operation, located at 2,300 meters above sea level.

Energy shortages have also triggered some action by the mining companies, to the point that some players have even entered the energy business with large investments. That is the case of Xstrata Copper which, through Energía Austral, a subsidiary, will build three hydro projects in the south of the country with a total capacity of more than 1,000 megawatts.

Sergio Villegas, executive director of the Chilean Research Centre for Mining and Metallurgy (CIMM), said: "We need

to explore new energy alternatives that will allow for an effective energy matrix diversification. In the meantime, we are promoting energy efficiency related courses of action inside the mining production process. Nationwide there are interesting portfolios of hydraulic energy generation projects, but some environmentalists are opposing these. This is a very difficult subject indeed."

While investments and new technologies will help to solve the problems related to energy and water, from a production point of view Chile faces an inevitable challenge in the long run: to maintain its massive levels of production in a context of decreasing grades. In that respect, a good framework for exploration is fundamental and some critics argue that Chile, being probably the most stable destination for investment in Latin America, could also be more dynamic as far as its exploration market is concerned.

Bring in More Juniors

Luis Sougarret, president of the Chilean Institute of Mining Engineers (IIMCh) believes that there is room for improvement in this area. "The regulation states that every person is free to claim a concession, and then that concession can be kept forever by paying an annual fee, without having to carry out any work on the property," said Sougarret. "Concessions do not expire in Chile. The result is that 80% of the land is in Codelco or other majors' hands."

Pablo Mir, a lawyer specialized in mining issues from Bofill Mir Abogados, says that, on paper, there is a completely free market with regards to concessions. However he identifies the lack of available land as the main barrier blocking the entrance of new companies. "The system needs to undergo some changes in order to give negative incentive to keeping land blocked without it being used."

Juan Carlos Guajardo, executive director of the Center of Studies for Copper and Mining (CESCO), a think-tank, further develops this idea. "The whole regulatory framework in Chile is designed for very large operations and not for medium-sized ones," said Guajardo. "Moreover, the state has never shown any interest in compiling the necessary geological information and making it available to all the people that would be interested in it. There is a complacent vision of the sector in Chile that



José Pablo Arellano, president and CEO of Codelco.



Sergio Villegas, executive director of the Chilean Research Center for Mining and Metallurgy (CIMM).



Horacio Undurraga, president of providers association Aprimim.

is: 'If we already are a big mining district and the large mining houses are here, why should we change anything?'"

One positive development would be having Codelco sell the properties that do not interest the public corporation. Although it has released some land for smaller companies to explore, the company has to go through a rambling procedure to do so, transferring the land first to another state organization, the National Mining Company (Enami). The BHPs or Anglos are more flexible to sign agreements with juniors, yet the number of such juniors in Chile is proportionally small, in relation to the abundance of its natural resources.

Besides the difficulty of finding available land with potential and the subprime crisis that has made fundraising more difficult globally, another factor that helps understand the relatively low presence of juniors in Chile is the disconnection between the mining industry and the Chilean financial market. In Peru, the Lima Stock Exchange has successfully set up a junior section with international companies listed; but in Santiago this is not the case. The government, in an effort to change this, has

approved a law on competent persons. Even though it will take a few years before there is an established mining market on the exchange, the government is showing its intention to attract new investors and bring more dynamism in this area. The official country delegation sent to the PDAC fair in 2008 (a premiere for Chile) is perhaps a good example of a significant change of mentality.

The Mining Cluster

Indeed, selling the country as a mining destination that still offers great opportunities should not be a difficult task. Leaving aside the mineral richness of the Andes, something that countries like Argentina can also offer, Chile already has the necessary infrastructure and an impressive array of products and services suppliers to the mining sector, in what has been called the "mining cluster." A cluster that is a regional example and that has exported its products and expertise for years.

"My dream is to transform the services industry into a net exporter, as is the case in Australia" said Horacio Undurraga, president of Aprimin, an association grouping large providers to

Big Mining. "We have enormous potential for growth in the surrounding countries," Undurraga said. "Most of the member companies of Aprimin are present in Peru, Colombia, Argentina, Ecuador, Brazil and Bolivia."

As the region's mining sector develops, a focus on innovation will help Chile's providers maintain their leading position. "Local mining production activity must keep growing at least as fast as the world's mineral consumption. To meet the requirements of such growth, the Chilean mining cluster should become a knowledge-based cluster to improve productivity and meet new environmental, quality and social standards," said Diego Hernández, president of BHP Billiton's base metals division.

The Mining Council's Costabal affirms that Chile is going "from great to best." There is no doubt that this is the case for mines already in operation, but also for all of the providers involved. A modernization of the exploration market seems to be the next step, as everything else is in place: political stability, natural resources and infrastructure—the perfect ingredients that have made Chile the world's largest copper producer.

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“Codelco Must be Run as a Corporation”

Interview with Santiago González Larraín, Chile's Minister of Mining

What are the main highlights and initiatives under your mandate?

When my team took over the Ministry in January 2008, a number of great challenges lay on the table in front of us. This institution is in charge of two important services: Sernageomin, which takes care of the basic geology of the country as well as ensuring companies comply with safety regulations; and Cochilco, which gives advice to the government with regards to technical studies as well as acting as a watchdog over state-owned companies. Additionally, the Ministry of Mining is responsible for the relationship between the government and the state-owned companies participating in the mining sector. As Minister of Mining, I am also chairman of the board of Codelco, Enami and Enap.

This Ministry has very precise aims for fulfilling the current mandate (which will expire in March 2010). With regards to the laws, we are focusing on passing and implementing the law on competent persons. We are also working on a law on mine closure planning, which does not yet exist in Chile. We are furthermore elaborating a law on environmental liabilities, for which we have identified approximately 370 areas with environmental problems from the past.

Finally, we are advancing with a new law for the corporate governance of Codelco. The company needs modern corporate governance to boost its efficiency and agility in order for it to compete with the other major mining companies.

What is the vision for Codelco's future?

Codelco is a very important company for Chile and its profits play a great role in funding the state's social initiatives. We believe that Codelco can be efficient as a 100% state-owned company, and that it must continue under the control of the state. However, it is managed under a law from 1975 that is old, inefficient, and tiresome for the daily operations of the company. We want to set up a new legal framework that will allow Codelco to be run as a corporation. There must be a technical board of directors that delegates to a general manager. Today Codelco has a CEO who is governed under conditions set by



Santiago González Larraín, Chilean Minister of Mining.

law, as well as a chairman of the board—the Minister of Mining—with other competencies given to him by law. This duality is not good for the company. In our opinion, the Minister of Mining should not sit on the board of directors. We hope that the new law will be approved by Congress in the coming months, in order for Codelco to have a new framework for corporate governance in 2009.

Codelco, in the next 10 years, is going to develop projects worth more than \$12 billion. We therefore need a technical board that is exclusively focused on what is best for the company. We need to separate the daily management of Codelco from the different political cycles. Nowadays, every new government appoints new executives and that prevents the existence of a long-term vision for the company. If the separation between the management team and the government is clear, the problems of the company, like the recent conflict with the subcontractors, will be dealt with at a company level and not at a political level. In the project we are preparing, there will be no ministers on the board, and two of the seven directors will be completely independent.

Should Codelco be obligated to give 10% of its revenue to the armed forces?

That provision needs to be eliminated. It is an unnecessary burden for the company. The armed forces have to receive their funding from the state's budget like they do in every other country.

What is the timeline for the current legislative initiatives?

The law on competent persons has already been passed by Congress. This is key as it will open the door for mining companies to enter the stock market; and even more importantly, it will eventually lead to a new junior section within the stock market as exists in Peru, Canada and Australia. It will incentivize exploration and attract new junior companies that do not have access to the Chilean investment community today. The Chilean financial system is heavily regulated and is very conservative, but we believe that with this piece of legislation and our political will, we will achieve our objective of having a junior market.

Following this we would like to have the law on mine closure plans approved before the end of 2008, and the law on environmental liabilities approved during 2009.

How does the Ministry react to claims that Codelco and the other majors hold rights to an unfair proportion of the most attractive undeveloped mining properties?

We are working on this as well. At Codelco, we are carrying out a deep study for the company in order to release the mining properties that are not interesting for the corporation. This year, through Enami, we have already released 40 mining properties. Another way of helping the market is to reach joint ventures between Codelco and other companies. There have been three such ventures and another three are in the pipeline. Inca de Oro, a sizable project, is a good example of this.

In Chile, mining property is a very strong right and it is therefore not easy to introduce changes. To start with, the mining property is not granted by the government but by the courts of law. However, we could explore some new options. For instance, there was a change in water rights when a yearly fee was introduced; nowadays—and unlike in the past—it is possible for a company to lose its water rights if it does not use them. Something similar could be done for mining properties, but this is not on our agenda at the moment.

Chile is in the top six to seven countries in the world with regards to exploration, so there is potential. However, we will need to

improve the framework for the junior companies so that they can have access to the required funds. Chile is perceived as a mature market but that needs to be seen in perspective, because all the majors keep undertaking big exploration programs in the country.

What is the role of small mining companies in Chile?

We put a lot of effort into developing the market for small mining companies. These are very important in Chile as they create a lot of employment and help with the development of the majors as they undertake a large amount of exploration on a small scale. Through Enami we have a strategy to promote these small entrepreneurs, especially in the north where apart from mining there are not many economic activities. The amount of minerals that small miners produce is very important overall for the economy of the country.

What are the plans to further encourage growth in the mining services sector?

The services provided to the mining sector have experienced strong growth, especially in the north of the country, in recent years. There are large multinationals that have set up their bases here in order to serve the big mining operations. At a government and industry level we have created the national mining cluster, a council participated by the public, private and academic sectors. Its aim is to give recommendations on the big strategies to promote the services sector.

There are four strategies; the first one is innovation, and for this we are funding the best innovation projects with \$24 million (public and private funds). The second one is the development of human resources as there is a scarcity of skilled talent servicing the mining sector, especially in technical areas. The third strategy is to improve the attraction of Chile for mining investment as we want companies to set up their shops in Chile. Finally, the fourth strategy is internationalization, to reach the overseas markets from the Chilean base.

Where do you see the main challenges for the development of the mining sector?

The first one is exploration. We need to create the framework to bring in new explorers. Once this has been achieved, we will be facing a greater problem with regard to the availability of water. We are trying to define a national policy together with other sectors like agriculture. People tend to

point at the mining industry as the largest single consumer of water, but this is not the case, not even in the north. The third challenge is power generation, and obviously without energy there is no mining. There are two big projects for gas plants, in Quintero and Mejillones, which will be able to import LNG to the national grid—this will help following the cut off of gas from Argentina. These plants will be operational in late 2009-2010 and will have a positive impact on the industry.

How can Chile improve relationships with its neighbors so it can import gas from them?

As a community of nations in Latin America we have an obligation to move forward. However, this is not as easy as it sounds as every country faces political pressures with regards to the energy issue. For this reason Chile, in parallel with its diplomatic efforts, needs to invest in its own supplies. Besides these two large gas plants, we are very active in the area of Magallanes, exploring for oil and gas.

What are the main opportunities ahead for the Chilean mining sector?

The opportunities are enormous. The advantage Chile has over some of its neigh-

bors is that the rules of the game are very stable here. The obligations and the taxes for mining companies are very clear. There is a decree regulating foreign investment that has not been changed in 20 years. It is a guarantee that the rights of the investor are going to be upheld and respected. We do not try to use the mining sector as the industry that will solve the state of public revenues overnight, we want companies to come and stay for the long term.

There has been great political stability since the end of the military regime. There have been no conflicts and that is very important. We do not have problems with the communities, because mining in Chile is done in areas with very little population density. The environmental regulations are very clear and strict with the basic points of sustainability. The conditions are very clear and they are fair.

The enormous geological potential, mainly in copper, makes the country very attractive for foreign investment. Indeed, FDI has increased dramatically over the last 15 years, when Codelco accounted for 75% of the country's copper production. Today, Codelco only makes up 30% of the output, and this is because of private companies that have grown enormously.



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There is no better way to counter arguments against the idea that Chilean mining has reached maturity than by having a look through the project portfolio of the country's largest mining operators. While grades may be decreasing, the country's total reserves are not. The majors are attempting to increase their production against the challenges presented by increasingly difficult ore bodies.

One of the companies that best demonstrates the need for new investments is Codelco, the No. 1 copper producer, whose output of 1.66 million metric tons (mt) of fine copper in 2007 represents a constant decrease since 2004's 1.84 million mt. The first half of 2008 continued the negative trend, partly because of industrial action by the corporation's subcontractors. The curve is in contrast with the aggressive growth of private competitors in the last years through acquisitions and mega-mergers, one of which (probably involving BHP Billiton, Rio Tinto, Xstrata or Vale) will eventually lead to Codelco's loss of its pre-eminent position at the top of the copper league. This provokes a controversial debate over the need or not for partial privatization to improve efficiency.

"The decision-making process in the public sector is aimed at the reduction of risk, but that applied to a company is an

obstacle for growth," said Juan Villarzú, former president and CEO, Codelco and current chairman of Apoquindo Minerals. "For this reason it is urgent to restructure Codelco, and leaving aside the debate about the ownership, what Codelco needs is to be able to operate as a company and not as a public service."

It would be unfair to forget the phenomenal role that Codelco has played in the Chilean economy over the years, a benefit that even the strongest champions for privatization will acknowledge. The discussion is actually to do with the way the company works, and, more to point, with its transparency and its ability to realize its growth potential. Asked about Codelco's corporate governance, José Pablo Arellano, the current president and CEO assures that Codelco "is already moving in the direction that the OECD advises for state-owned companies."

That is the political side. On the "real" side of producing mines sites and ongoing investments, the company spent \$1.7 billion last year. A significant portion of this amount went to the new Gaby mine, already in operation. Gaby will contribute 150,000 mt of copper cathode to Codelco's production in 2009.

The company plans to have the sulphide mineral phase of the Radomiro

Tomic mine up and running by 2010, treating 100,000 mt/d at the existing Chuquicamata facilities. Furthermore by 2014 the new Ministro Hales mine should be operational. This large ore body, difficult to reach and with high arsenic content, should yield "fantastic results" according to company sources, for its high grades in copper and, very importantly, silver as well.

The largest expansions, however, will be the ones at Chuquicamata, Andina and El Teniente. "At Codelco Norte, Andina and El Teniente we are implementing projects that are normally undertaken every 50 or 60 years. These are big structural investments and in that sense we are building the Codelco of the coming decades," said Arellano.

In terms of production figures, Andina will be the division that will have the most radical impact. The planned investment here is to be made in two phases, the first one to reach 94,000 mt/d in 2010, and the second one, a massive \$4.5 billion expenditure, to take it up to 244,000 mt/d by 2015.

Then, the company will spend over \$2 billion to build the new mine level at El Teniente underground mine, which should be operational by 2017. El Teniente, in production for over a century, will thereby ensure its future operations for another 60 years with this new level.

Last but not least, the enormous Chuquicamata open-pit mine will go underground in 2018 after an estimated \$2 billion investment. "This will be a remarkable challenge, both in terms of technology and in terms of managing the change from open pit to underground," said Fernando Vivanco, vice president of projects at Codelco. "Chuquicamata is the biggest open-pit copper mine in the world and we are planning on transforming it into an underground mine similar in size to El Teniente, which is the world's largest underground copper mine."

Behind Codelco, the second largest copper producer in the country is BHP Billiton, which operates Escondida (57.5% owned), Cerro Colorado and Spence, a relatively new open-pit opera-

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tion started in late 2006. Of the three, Escondida is by far the largest—it is indeed the largest single copper producer worldwide—and the one where the company plans to carry out its most significant expansion investments. Diego Hernández, president of BHP Billiton's Base Metals Division, said: "The largest project in the pipeline is the construction of a third concentrator plant at Minera Escondida. The project, which is currently in the pre-feasibility engineering stage, would allow us to mitigate the decreasing ore grades and improve Escondida's production potential in the long term."

BHP's share of the production at Escondida (co-owned by Rio Tinto, 30%; JECO Corporation, 10%; and the International Finance Corporation, 2.5%) in the year ended June 2008 was 679,500 mt of copper concentrate and 131,600 mt of copper cathode. Total copper production is expected to decrease by 10%-15% in 2009 due to lower grades, and then should stay stable for a few years according to BHP sources. To guarantee the mine's production in the long term, the consortium is investing significantly in brownfield exploration. In June 2008, BHP announced the discovery of a new deposit in the Escondida lease area, called Pampa Escondida. It is a porphyry copper body of at least 1 billion mt and grades ranging from 0.6% to 1% copper.

Escondida already has a desalination plant in place and plans to build a second one to support its future expansions, namely the introduction of a third concentrator plant. "Sea water desalination is a relatively more expensive and technologically complex water supply option, but its use makes strategic sense given the size and quality of the ore deposit at Escondida," said Hernández.

Collahuasi's Massive Expansion

Codelco and BHP are not the only ones deciding to pour money into their Chilean assets. Collahuasi, a large mine that produced 452,000 mt of fine copper in 2007, could more than double its size if its owners' plans go ahead in the next six years. A joint venture between Anglo American (44%), Xstrata (44%) and Japanese investors (12%) led by Mitsui & Co., the operation is currently boosting production from 130,000 mt/d to 140,000 mt/d to have an additional 30,000 mt of copper output yearly. Reaching 650,000 mt of copper in 2010 through the expenditure of an extra \$750 million, the idea is to further expand this gigantic operation to produce 1 million mt annually by 2014.

Apart from its stake at Collahuasi, Anglo American operates four 100%-owned mines in Chile: Los Bronces, Mantos Blancos, Mantoverde and El Soldado, as well as the Chagres smelter. Of all the plans to extend mine life or increase production, the expected investment at Los Bronces is the most noteworthy, as Anglo American's CEO Miguel Ángel Durán said: "Our flagship project is the sulphide expansion of Los Bronces to double its total capacity. It is a capital expenditure of \$1.74 billion that will require up to 7,000 people during the construction phase. Our objective is to complete the construction in late 2010 and to be in production by Q1 2011. We are going to have the biggest SAG mills available and the technology used will optimize productivity and reduce costs to the minimum." Increasing the mill throughput from 61,000 mt/d to 148,000 mt/d, Los Bronces will add an average of 170,000 mt/y to the existing production capacity.

A look now at Xstrata Copper, Anglo American's partner at Collahuasi, who became active in Chile through the acquisition of Falconbridge in 2006. Its Lomas Bayas mine, a medium-sized



Production of copper cathodes at El Teniente (Codelco). (Photo courtesy of Rory Sheldon)

operation, is increasing from 65,000 mt/y of copper to 75,000 mt/y. Xstrata is also investing in its Altonorte metallurgical complex, where it will augment the copper anodes production from 270,000 mt/y to 380,000 mt/y, and the sulphuric acid production from 800,000 mt/y to 1.1 million mt/y to respond to the high demand for this product in the market.

Moreover, Xstrata Copper owns 70% of the El Morro project (the remaining 30% is with New Gold, formerly Metallica Resources). Juan Pablo Schaeffer, manager corporate affairs at Xstrata Copper, said: "El Morro is a copper-gold flotation project that, according to our current studies, will produce 150,000 mt/y of copper per year and 300,000 oz/y of gold. The project is located in an area where water is scarce, and where the local communities are active in agriculture. That is why we have thought of a desalinating plant in our feasibility study to make the project sustainable in front of the local communities." The estimated capital expenditure for El Morro would be roughly \$2.5 billion.

Another multinational with an important presence in Chile is Freeport-McMoRan, that controls the Candelaria and Ojos del Salado operations (both with an 80% stake, the remaining 20% being with Sumitomo) as well as El Abra, a 51%:49% partnership with Codelco. While Ojos del Salado is a relatively small copper and gold complex, Candelaria and El Abra are larger copper operations that produced 181,000 mt and 166,000 mt copper respectively in 2007.

It is at the latter that the Arizona-based company will exert its biggest

expansion efforts, as Miguel Munizaga, vice president of Chilean Operations, said: "The main project we are currently undertaking in Chile is the El Abra's SulfoLix project, which obtained environmental approval in March 2008. The project will extend the mine life by more than 10 years at an average production of 325 million lb/y of copper. Copper production from sulphides is expected to begin in 2010, and the total capital investment is expected to approximate \$450 million."

Teck (formerly Teck Cominco) also has copper-producing assets in the country after it acquired Aur Resources in August 2007, and subsequently took over the Quebrada Blanca and Andacollo operations, with 76.5% and 90% controlling stakes, respectively. These will not be their last acquisitions in Chile, as the company has also taken control of the Relincho porphyry copper-molybdenum project from Global Copper Corp. during 2008.

Quebrada Blanca produces in the region of 80,000 mt/y of copper cathode.

In May 2008, Teck announced a new inferred resource in the hypogene deposit, of 1.03 billion mt of ore at 0.5% copper and 0.02 molybdenum, representing 11 billion lb of copper and 450 million lb of molybdenum. With regard to Andacollo, a smaller operation, the mine produced 18,600 mt in 2007 and expectations for 2008 are of approximately 20,000 mt.

Chilean Private Investment

In addition to Codelco, the main Chilean player in the marketplace is Antofagasta Minerals (AMSA), controlled by the Luksic family and a subsidiary of London-listed Antofagasta PLC. The company operates three mines in Chile (Los Pelambres, El Tesoro and Michilla) and expects to increase its total copper production by 8% this year to reach 463,000 mt. 60% owned Los Pelambres, the largest operation of the three, is also producing around 6,800 mt of molybdenum this year, less than in 2007 due to lower grades.

Antofagasta Minerals is in the middle of an ambitious expansion plan, which includes the development of medium-sized Antucoya (near Michilla); a \$1 billion investment at Los Pelambres for an extra 90,000 mt/y production; and a \$1.9 billion new operation, the large copper-gold-silver Esperanza project (30% owned by Marubeni). Antofagasta Minerals was the first company in Chile to use seawater for mineral production (at Michilla in the 1990s) and will resort to the ocean again for Esperanza. This time, at a much larger scale, as Marcelo Awad, president and CEO, emphasized: "We will have to pump the sea water for 145 km in a pipeline, and just doing that will cost us \$275 million. We will need four pumping stations that will consume 40 megawatts in total. We will desalinate only 10% of the total



Miguel Ángel Durán, CEO of Anglo American.



Marcelo Awad, president and CEO of Antofagasta Minerals.



Julio Binignat, vice president Chile, Kinross Gold Corporation.



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water pumped, for camp consumption purposes and for the cleaning of the final product.”

Already the fourth largest copper producer in Chile, Antofagasta Minerals is expanding overseas, notably through its joint venture with Barrick for the copper-gold Reko Diq prospect in Pakistan, and also in Africa where the company has an agreement with South African TEAL for properties in Zambia. “After our joint venture in Pakistan, we feel we are ready to go anywhere in the world,” Awad said.

Gold as Well

Not everything has to be copper. With the unstoppable decrease in gold production in places like South Africa, the Andean region offers interesting opportunities for new ventures. The main gold-focused players in the market are Yamana, Kinross and Barrick.

In 2007, Yamana bought Meridian Gold and obtained two important assets in Chile: El Peñón, the country's largest gold mine, and Florida. Production in 2007 was about 383,000 and 68,000 gold equivalent ounces respectively, altogether representing close to half of the company's total output in the Americas. Yamana expects to substantially increase production in both operations in 2009, with prospects of reaching between 460,000 and 480,000 of gold equivalent ounces at El Peñón and 110,000 at Minera Florida.

For its part, Kinross also produced more than 400,000 gold equivalent ounces in 2007 between its 100%-owned La Coipa and Maricunga mines (197,000 and 206,000 oz respectively) and is actively working to extend the life of the mine in both sites, looking at opportunities in the surrounding areas. “We think we can increase the life of Maricunga past 2020 and thus it will make up a large part of the mining future for Kinross in Chile,” said Julio Binignat, Kinross' vice president for Chile.

The company, which is expanding aggressively at a global level, is spending nearly 30% of its exploration budget in the Andean region, notably Argentina, Chile and Ecuador. “There are opportunities to find gold deposits in the Andean region which will likely fill the void left by the shortage in South African production,” said Binignat.

A good example of those opportunities is the Cerro Casale project, defined by the



Minera Valle Central produces copper and molybdenum concentrates from the tailings of Codelco's El Teniente mine. (Photo courtesy of Rory Sheldon)


company as "one of the largest undeveloped gold-copper deposits in the world," and of which Kinross owns 49% (Barrick has the controlling stake). Binvignat underlines the impact that this project could have for the company, should it go ahead. "Cerro Casale has over 1 billion mt of ore and will provide somewhere around 11.2 million oz of gold and around 2.8

billion lb of copper for Kinross. Moreover it is surrounded by a number of satellite deposits which are yet to be evaluated, and it is located close to our other mines in the Maricunga district, which makes access to the site substantially easier. I believe Cerro Casale will become a huge project and play a large role in the future of Chilean mining," said Binvignat.

Kinross' partner at Cerro Casale, Barrick, is the world's largest gold producer. In Chile, however, it produces copper at its Zaldívar mine, with an output of about 142,900 mt of copper in 2007. The site has been suffering from sulphuric acid shortages during 2008. Besides Zaldívar and Cerro Casale, where the company is working on the feasibility study, Barrick is having its patience tested at its large cross-border Pascua Lama gold-silver-copper project that, more than two years after it received approval from the Chilean authorities, is still awaiting the granting of some permits in Argentina, and the resolution of a tax and royalty agreement between the two countries.

According to the company, Pascua Lama contains 18 million oz gold, 731 million oz silver and 662 million lb of copper. Figures that show the extent of the natural richness in this region that is still in the ground.

With majors investing vast amounts of money to improve their operations and large deposits awaiting the final thumbs up, there is no doubt that Chile will remain a country of big mining for the years to come.



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Santo Domingo Project, Chile
 A scoping study was completed in May, 2008 on the Santo Domingo Sur and Iris copper-iron deposits. The study provided positive economic values at various copper and iron price scenarios with annual production of 70,000 tonnes of copper and 4 million tonnes of iron concentrate.


The Project is located very close to excellent infrastructure and has the potential to become a mid-tier producer of copper and iron concentrates by 2012.

A resource report, completed in September, 2007, provided an Indicated Resource 202.6 Mt grading 0.55% Cu at 0.3% cut-off for the Santo Domingo Sur and Iris deposits and 31.7 Mt grading 0.55% Cu at 0.3% cut-off for the Estrellita deposit.

Subsequent drilling in 2008 resulted in the discovery of additional copper-iron mineralization close to the planned pit outlines, including the Iris Norte deposit, and identified the potential for future discoveries.

Australia and Argentina
 The Company is actively exploring exploration projects in Queensland, Australia (silver-lead-zinc) and in Catamarca Province, Argentina (copper-gold).

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Opportunities for Mid-Tier Companies

Majors want nothing but large deposits, which potentially leaves a lot of space for medium sized players in Chile

From companies with production elsewhere and now looking at new opportunities in Chile, to companies with mines or projects of various sizes in the country, the prospects for new mining developments in this tier of the industry are good in Chile, but are obviously overshadowed by the majors' massive investments.

For those already active in the country the challenges might relate to the access to financing within Chile or to the shortages of energy and water in certain areas. Those who are looking at Chile from the outside, however, may have to overcome a psychological barrier: are there sufficient opportunities up for grabs in a country seen as "mature" for years?

The answer seems to be positive. Inmet, a Canadian copper-focused company with mines in Turkey, Canada and Finland and interests in other countries (notably Panama and Spain), is back in Chile after a previous venture started in

the 1990s. "All we needed to justify our return into Chile was: 'is there ground available?'" said Friedrich Speidel, regional exploration manager, Inmet. "With the limited amount of time we have been here, we can say 'yes, it is possible.'"

The company has been doing generative work in Chile since mid-2007 with the result of three properties in the area of Copiapó. Inmet is also interested in acquiring advanced projects from third parties, with a target on deposits capable of producing 100,000 mt/y of copper. In Chile, that means porphyry or IOCG deposits.

Asked about what could be done in Chile to improve the exploration market, Speidel mentioned the lack of an up-to-date claims database and modern geophysical data on a regional scale and at a reasonable price. He is also of the opinion that claim acquisition procedures

should be simplified. This "wish list," however, is without prejudice to the potential of Chile for new discoveries. "Given the country's predominance not only as a copper producer, but also in terms of copper reserves, we believe exploration investment in Chile is still warranted," he said.

Another company looking at Chile to increase its existing copper production is Quadra Mining, who operate the Robinson mine in Nevada. In the past, Quadra's founding partners were in charge of the development and construction of Lomas Bayas, currently in Xstrata's hands. Today, the company's focus in Chile is the 100%-owned Sierra Gorda project, acquired in 2004 and located in the Atacama desert.

In May 2008, Quadra updated Sierra Gorda's mineral resource estimate to the current 10.6 billion lb of copper and 474 million lb of molybdenum (indicated),



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Since its formation in December 2004, Andina Minerals has rapidly grown the resource base at its Volcan Gold Project through a series of aggressive exploration campaigns and has recently completed its largest program to date, the Phase IV campaign with a 126% increase to measured & indicated resources to 6.6 million ounces of gold and 2.8 million ounces of gold in the inferred category*. The 9,450 hectare Volcan property is well-positioned in Chile's prolific Maricunga Gold Belt among a number of large porphyry deposits, including the Maricunga gold mine (Kinross), the La Coipa gold/silver mine (Kinross), the Cerro Casale gold/copper deposit (Kinross/Barrick) and the La Pepa gold project (Yamana).

*For further information on Andina's resource, please see the press release dated July 21, 2008 or visit our website.

Contact:

Carl B. Hansen, President & CEO
56 Temperance Street - 3rd Floor
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Symbol:	ADM (TSX-V)
Shares O/S:	79.3 million
Shares F/D:	87.5 million

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plus 5.5 billion lb copper and 211 million lb molybdenum (inferred). "In many ways Sierra Gorda is very similar to Antofagasta Minerals' Esperanza in terms of grade and of the general geology of the deposit," said Patrick Fahey, vice president exploration, Quadra Mining.

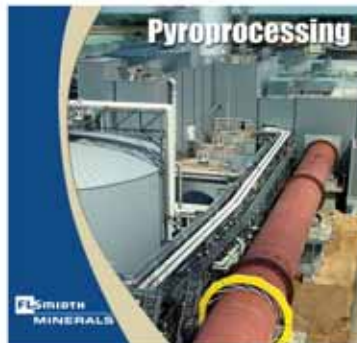
Quadra has acquired water rights of 448 liters per second (l/s), which is "a significant portion" of the overall water requirements at Sierra Gorda. "Our current thinking is that the Sierra Gorda project could comprise both an oxide heap leach operation as well as a large primary sulphide production facility and require in the range of 600 to 700 l/s based on a conceptual 120,000-mt/d mill capacity," said Fahey.

Fahey declared to be "really impressed of how well Chile works." A feeling shared by another mid-tier company's executive, Richard Colterjohn, president and CEO of Centenario Copper, "The fiscal environment, legal regime, pro-mining culture and transparency of the permitting process are all outstanding." Colterjohn notes that labor costs are increasing and that there is a shortage of power, but also that "these issues are a reflection of the success of this country."

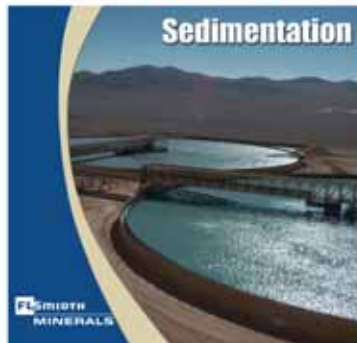
Project-wise, Centenario is constructing its Franke mine, expected to start-up by the end of 2008. Franke, an eight-year 30,000-mt/y cathode operation, has the particularity of a high carbonate level which results in the need of big amounts of sulphuric acid. This "Achilles heel," however, is mitigated by the reasonably high grade of the deposit (0.82%), the good recovery rates and Centenario's life-of-the-mine contract with a sulphuric acid supplier based on copper market prices instead of sulphuric acid market prices.

The executive team at Centenario wants to take advantage of the existence of numerous small and medium-sized copper deposits in Chile, and for that they are following what Colterjohn calls the "clustering strategy." "If we can generate enough mt of copper reserves to justify building a mine and bringing the infrastructure in, why not extend the mine life or even increase the size of the plant with little incremental costs by clustering other deposits around it," asked Colterjohn. Centenario has a property near Franke called Pelusa, where it has carried out 85,000 meters of drilling and had four discoveries. "That by itself will allow for

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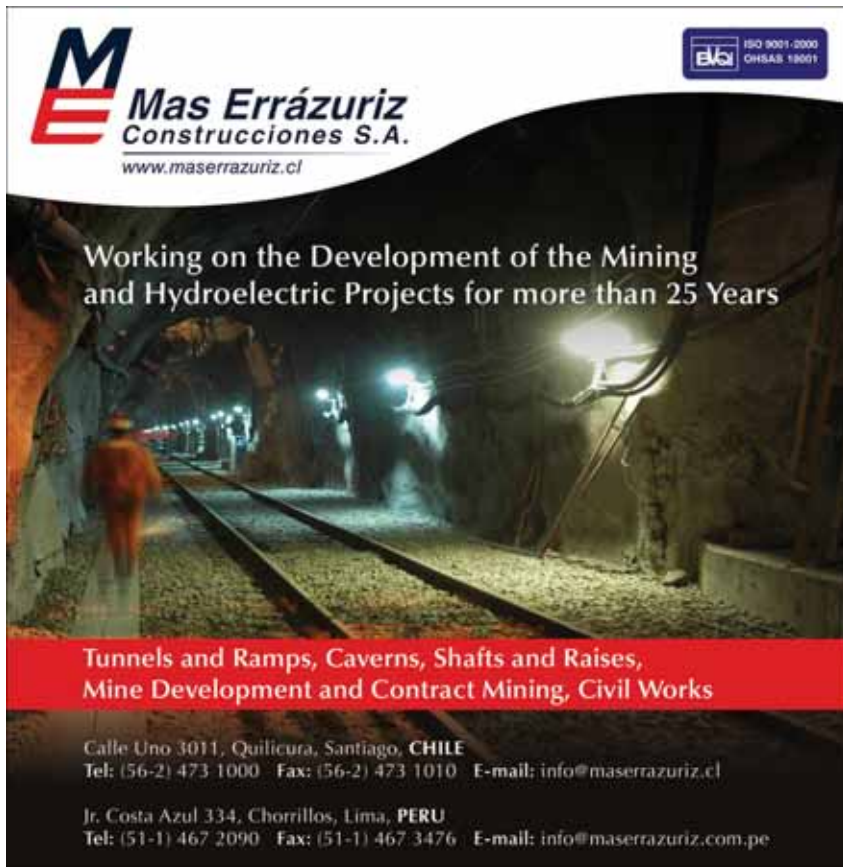


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Centenario Copper Corporation (CCT-TSX) is a development stage copper company active in Region II and III of Chile. The management team is committed to creating shareholder value through the successful start-up of the Franke SX-EW copper mine by the end of 2008 and then by pursuing opportunities to leverage the Franke infrastructure by clustering with other in-region copper deposits.


centenario
COPPER CORPORATION

an extension of Franke's mine life or possibly a 50% expansion of the Franke processing plant," Colterjohn predicts.

Neighboring Franke's site is Barreal Seco, one of the four properties of the Flores copper project by Coro Mining. The Vancouver-based company is working on the area, with resources currently standing at roughly 1 billion lb of copper (all categories), with a view of completing a definitive feasibility study by Q2 2010 and start production in late 2011.

Coro Mining, who also had an option to purchase Minera Cerro Negro, a 10,000 mt/y copper operation in Chile, released a note in October stating that the decision had been made not to go ahead with the planned acquisition, as market conditions had "dramatically changed." A few weeks before the stock exchanges crashed worldwide and copper registered its lowest prices in more than three years, Coro's vice president of operations, Juan Carlos Román, discussed access to funding in the Chilean mining sector. "The advantage of Chile is that this is a mining country and that should reassure the Chilean investors. Obtaining the funds in Chile is possible, but much more expensive than abroad. The banks and the stock market need to learn about mining," said Román.

Profitable Leftovers

The majors hold assets that are potentially appetizing for medium-sized companies, and not simply unexplored land. The gigantic size of some of the copper operations in the country, together with audacious entrepreneurship in times of high metal prices, has shown the market that processing someone else's tailings can indeed be profitable.

Minera Valle Central (MVC), has been operating the tailings of Codelco's El Teniente mine since the 1990s, and was acquired by Amerigo Resources, a Canadian company, in 2003. "Amerigo came in with the idea of making money by investing money, especially because the price of copper was then on the rise," said Raúl Poblete, general manager of MVC. "In 2004, we expanded the copper grinding facilities, and in 2005, we built our molybdenum plant."

In 2007, the company produced 15,000 mt of fine copper and 290 mt of molybdenum. Its net earnings amounted to \$24 million last year and \$12.6 million in the first half of 2008. Poblete explains the secret: "We take a 0.1%

copper feed to the plant, and at the other end we obtain a 30% copper concentrate. The concentrate grade is thus 300 times higher than the feed, giving a concentration ratio that is one of the highest in the world, if not the highest one. In the case of molybdenum, this ratio is even higher, going from 0.005% to 48%.”

To reduce the impact of “unprecedented power costs,” MVC is installing a 20-megawatt power generation plant. The company would like to reach production levels of 27,000 mt of copper and 450 mt of molybdenum sometime between 2009 and 2010. For that, the expertise of the company in this particular business model will be essential. “We have 17 years experience and we feel that we are experts in the field of recovering copper from tailings by flotation. We think we can do this job better than anybody else,” Poblete said.

Other “leftovers,” deposits that the majors evaluated as too small, can be potentially big for smaller companies, and ask for investments in the hundreds of million dollars to go into production. That is the case of Santo Domingo, a copper and iron ore project left behind by BHP Billiton in the past and now in the hands of Far West Mining, a TSX-listed company based in Vancouver and with interests in Argentina and Australia as well as Chile.

Figures for Santo Domingo currently are 240 million mt at 0.54% copper, 24.3% iron and 0.07 g/mt gold, which is a Cu equivalent grade of 0.87% at the company’s long-term metal price assumptions. After the scoping study was completed in May 2008, additional mineralization was discovered. A further 5,000 meters are being drilled in the last months of the year for a new resource estimate, which is expected to be released in Q1 2009.

The scoping study currently in place foresees a \$941 million investment for an annual production of 65,000 mt of copper and 4 million mt of iron concentrate, starting in 2012 or 2013. The life of the mine would be 14 years. “The company will obviously need a major partner to handle such a large capital investment,” said Miguel Tobar, manager of business development, Far West Mining. Another option would be recovering just the copper, which would need a capital expenditure of \$750 million.

“BHP Billiton elected not to proceed at Santo Domingo because it was too



Chilean copper miners employ state-of-the-art technology, such as the Andina control center, to keep their competitive edge. (Photo courtesy of ABB)

small for them. As Far West, we started with 40 million mt; now have 240 million mt and we haven’t finished defining our deposit yet,” Tobar said. The project will need 300 to 350 l/s for the milling operation, and as is the case for other companies, water is one of the main challenges. “We believe we have the potential to secure some or all of our water on our own property, but we are also having discussions with Codelco. With the impending shut-down of the El Salvador mine in 2011-2012 we could

have access to water, power and qualified staff.”

More Than Copper

Chile is not just about the red metal, even though the number of companies exploring for gold is not high and still reflects the difficulties faced by the junior sector in the decade before 2004. “That negative cycle put us all against the wall and provoked a merger boom that left the gold industry

(Continued on p. 105)

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A Perfect Storm of Demand

Demand for mining services in Chile has rocketed with the copper boom in recent years. Will that continue with the financial crisis?



Komatsu's 930E autonomous trucks were tested at Codelco's Radomiro Tomic mine.

Call it goods, services or both, Chile is home to a sensational number of providers to the mining industry, many of whom serve not just Chile but the whole Latin American region. Companies choose Santiago as their main location for Spanish-speaking Latin America (Brazil tends to be kept apart on account of its size and different language) not just because of Chile's economic and political stability, but because it is at the center of action.

With a handful of copper mines producing in the range of hundreds of thousands of tons of copper per year, and with operators increasing the already very large mineral throughputs, it is easy to imagine the levels of service and supply that are needed by the mining companies in Chile. As an example, Codelco alone sought help from more than 4,000 providers in 2007.

From manufacturers of large pieces of equipment to drilling contractors, and from laboratories to companies involved in the power business, Chilean goods and services providers have a success story to tell.

Big...and Smart

A common trend with all providers is their effort to continually add value to their mining clients and to go beyond the mere supply of products to providing tailored solutions. This involves countless aspects, including after-sale service,

maintenance and repair contracts and innovation in new technologies.

With regards to the latter, one major breakthrough has been the use of autonomous trucks in a mining operation undertaken by Komatsu for Codelco. The system had been tested at Radomiro Tomic since 2004, before 11 trucks were put to work at Gaby in the beginning of 2008. It is Komatsu's first full-scale autonomous operation, and a premiere worldwide. "The autonomous trucks project had been pursued by Komatsu for around 20 years," said Jeffrey Dawes, president, Komatsu Chile. "When the technology reached a certain level, we realized that the real advantage was in the biggest trucks, so we adapted the technology to our 930 model."

Dawes notes that the system requires a change in the mindset of the mine planners, since it involves not just the trucks, but also the other vehicles in operation, increasing the complexity exponentially. "There are some hardware restrictions still. The amount of information being exchanged between the trucks and the central control system is enormous. At Gaby we have 11 trucks and 30 pieces of equipment in the area, that is more or less the limit with the technology we have today for information transfer."

With regards to the future of this technology, Dawes affirms that the company will eventually improve it to the point where there will be no limitations, but

that will have to be done very carefully. "We are making sure that we advance very slowly so there are no backward steps," Dawes said. "The autonomous truck technology is in the limited release stage, where we have one operation in Chile and another one starting soon with Rio Tinto in Australia."

Autonomous trucks are obviously this year's highlight for the company's mining business and it is no coincidence that Chile is at the forefront. As Andrés Aguirre, general manager of Komatsu, makes clear, "Chile has 30% of the 300 mt trucks produced by Komatsu, and the same applies to the PC5500 hydraulic shovels."

For other manufacturers, Chile also represents a very important source of revenue. In the case of Caterpillar, its products are distributed by Finning, a Canadian-based dealer with which it has exclusive distribution agreements in Chile and other Latin American countries. Juan Antonio Winter, vice president mining at Finning, describes how the business has changed with the different mining cycles. "Before the 1990s we basically sold equipment in parts, and then we started moving toward full service operations and maintenance contracts. We have now focused ourselves on being a product support company. We sell equipment, but our primary purpose is to provide product support, which accounts for 60% of our revenues."

With the factories order sheets full, one of the main challenges for a dealer like Finning is to guarantee the delivery of equipment. "In the past it was unthinkable to have stock equipment for the mining sector; one truck can be worth more than \$5 or \$6 million, and having one of these sitting around is risky," said Winter. "However, at some point we saw that we just had to have products in stock. As a distributor we are at times managing about \$100 million worth of stock."

Finning's stock of products has increased to respond to a business environment that John Oliver, Bucyrus' vice president for Latin America, has described as "a perfect storm of demand." "We have a fleet of installed equipment that is aging and needs replacement. Typically, a mining shovel is changed because the truck size becomes larger. The brownfield projects have lower-ore grades so they need to increase capacity for the same amount of mineral production. And at the same time we have the greenfield sites. It is a very exciting situation," Oliver said.

Bucyrus, a manufacturer of products for surface mining (walking draglines, large electric shovels and rotary blast-



The headquarters of Weir Minerals' South American division is in Santiago. (Photo courtesy of Rory Sheldon)

hole drills) and that has recently entered the underground mining business through the acquisition of Germany-based DBT, has introduced a hydraulic crowd technology for its shovels this year. The company believes this is a major innovation that will have a profound impact on the business, while saving clients important amounts of time and money in maintenance.

Komatsu, Finning and Bucyrus, along with many other companies, raise concerns over the scarcity of expert technicians to increase their workforce in order to keep up with the demand. Winter affirms that almost one third of their staff at Finning have been hired in the last couple of years. And Oliver emphasizes the need of promoting the technical trades. "There's been a high percentage of dollars

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Luis Silva, president and CEO of Ingetrol, at the company's manufacturing unit in Quilicura, Santiago. (Photo courtesy of Rory Sheldon)

spent developing the university-level education in Chile, but our restriction is not going to be on the number of engineers, but on the number of mechanics, electricians and welders we can put on site."

This is a challenge that Liebherr, a relatively new player in the Chilean mining sector, will need to overcome in order to build a strong presence in the country. After using a dealer for some time, the Germany-based group decided to take direct control of the mining business in Chile. With more than 30 large trucks already running at Codelco's Chuquibambilla operation and 18 more joining the Radomiro Tomic mine between 2008 and 2009, Liebherr wants to portray itself as an alternative to the other manufacturers that already hold the majority of the Chilean market share for large trucks and excavators.

Wilfried Schilling, general manager of Liebherr Chile, affirms his company will increase sales very rapidly in the medium term. "We expect significant growth within the large shovels and excavators business, especially in the R996 type and the R9800 type, in the next five years. Furthermore, over the next five years Chile will acquire around 170 large

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trucks in the 300+ mt class and that is a great opportunity for our T282B. Ideally, I would like to see Liebherr selling 75 trucks of these 170."

In the medium term, Liebherr is also working on another truck model, the TI 274, which is already being tested and could be commercially available in 2010 if test results are good. This truck will have a nominal payload capacity of up to 290 mt and an empty vehicle weight of 170 mt, which promises the lowest cost per mt of hauled material according to the company. "Liebherr's commitment to technology is also evident with the in-house development of the industry's first 4 motor AC drive system," Schilling said.

Chile's Weight

As the size of the pie increases due to new investments, many opportunities are arising for both newcomers and long-standing players in the Chilean market, like Atlas Copco, a multinational with a base in Santiago for more than 50 years. Present in over 150 countries, Chile is among the five largest for the company in terms of sales. It is little wonder that the headquarters in Sweden very closely follow what is happening in the country. Indeed, the company is already working with Codelco to develop the equipment that will be needed at the Chuquicamata underground project, in about 10 years time.

For a company with a strong focus on innovation, Chile is one of the best places to work in all Latin America, as Atlas Copco's managing director, José Manuel Sánchez, notes: "Clients in Chile are very competitive and professional and like to have the latest technologies. Chileans are very innovative by Latin American standards."

Innovation does not only apply to renewing products (the company has just launched a new generation of its Pit Viper drills, for instance) but to the services offered which are adapted according to local needs. "One innovative service Atlas Copco offered was the possibility of providing finance to the Latin American market. That has greatly helped the small builder and the small miner, as they can plan their costs in advance," said Sánchez. Indeed, at the time of writing this report, costs have all of a sudden become an enormous challenge, especially for small mining companies, as the price of copper has dropped dramatically.

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José Manuel Sánchez, managing director, Atlas Copco.



Marcelo Ramírez, managing director, SGS Chile.



Hernán Conejeros, manager business development (mining), 3M.



Fernando Buttazzoni, general manager, Christensen Chile.

Cut Risks, Cut Exploration?

One of the likely victims of the financial crisis is the exploration market. Even if exploration in Chile is mainly undertaken by major mining companies, which have long-term projects and the financial strength to survive the crisis, the impact of the current climate of uncertainty is undeniable, and some companies acknowledged some order revisions or even cancellations from their customers.

On the positive side, many Chilean companies have grown to a certain size and deal with a diversified portfolio of geographic

markets and customers. Their strong focus on innovation and after sales services should help them to weather the storm.

Fernando Buttazzoni, general manager of Christensen, a manufacturer of tools for the drilling market, said: "We don't just sell off the shelf; we work together with the clients to provide solutions. Our advantages are that we have very good quality products and we are strategically located in the Chilean and Peruvian markets. Clients could source from abroad but we are right here and we know them: that makes a difference, because we give a continuous after-sale service." Buttazzoni also under-

lined that a quarter of the world's exploration budget is spent in Latin America.

The boom during the metal prices bonanza also led to the creation of new companies, such as Exploration Drill Masters (EDM), a manufacturer of drilling rigs. Started in early 2008 by two Australian partners with extensive experience in the drilling market, the company saw a niche in Chile as exploration was picking up, and introduced their EDM 2000 model, described by the company as a "medium to deep hole multi purpose machine that is modern, robust, safe and easy to operate."

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EDM assembles its machines in the outskirts of Santiago and likes to position itself as a highly specialized player. "We are not a big multinational one-stop shop supplier. We are a flexible and innovative exploration surface drill rig manufacturer. We focus on building the correct machine for the client and select markets with standardization and longevity in mind," said Christian Lyon, business manager, EDM. The company is also the representative in Chile for Schramm products, and plans to start manufacturing two new drill models during 2009.

Another drill manufacturer that has found its niche in the Latin American market, especially in portable rigs, is Ingetrol, a company that decided to go completely electronic on the control panel two years ago. "That was something of a taboo in the industry at the time, and still is to some extent. Electronics were seen as an insufficient and unreliable replacement, as compared to the rigor force of the manual levers. However, I can see that electronics is the future and the only way to take the industry to the next level. It's simple and does not require force. It's just the logical way forward for drilling," said Luis Silva, president and CEO of Ingetrol. The company is reinforcing its presence in international markets, with increasing sales in Africa, and a third office was opened recently in Mexico adding to their Santiago and Lima bases.

On the drilling contractors' side, one of the main players is Geotec, a company headquartered in Santiago, but with rigs in different Latin American countries, especially Peru, Mexico and Colombia, making up a total fleet of more than 120 machines. With more than 1,500 employees in Chile, the company's executive vice president Raúl Lyon points at the struggle to find enough operators in a country where the working environment can be very tough indeed. "The altitude is a big challenge for working in Chile. At 5,000 meters above sea level, temperatures reach -25°C at night. Everything freezes. We are very upfront with our workers, we explain exactly what to expect. It is a tough job, especially at these altitudes. But because of these hard conditions, salaries are higher than in other industries, and workers also have more time off than the average."

Other contractors in this field include Major Drilling, based in Coquimbo, and

Terra Service, a smaller company specialized in reverse circulation drilling and controlling a fleet of around 20 rigs. Seen in the past by a major drilling contractor as a possible acquisition target, Terra Service remains as an independent player with a vision to keep a medium size so as to better serve its core clients, among which they count Anglo American and Antofagasta Minerals.

Raúl Dagnino, general manager of Terra Service, prefers to have a smaller client portfolio and maintain a close relationship with them. "Geologists live up in the mountains and like to have a special relationship with their drilling contractor. The general manager of a large multinational won't be able to be very close to them, let alone drive five hours up to the Andes to pay them a visit."

Leaving aside the personal touch, the business is increasingly undertaken in the context of a partnership model with the objective of shortening delivery times and speeding up the exploration process: "Clients have to wait eight to nine months for RC drilling. We already have some multi-year contracts with our clients and the availability of rigs is very limited. Now more alliances are being forged because you can-



SalfaCorp was involved in the construction of Codelco's Gaby mine.

not get rigs overnight as was the case a few years ago. I expect more partnerships to take place in the market," Dagnino said.

Also related to the exploration market are the companies that offer laboratory tests for the samples obtained during a drilling campaign. In Chile there are a

number of these, including CIMM T&S (a subsidiary of the state's research centre CIMM); ALS Laboratory, whose mineral division ALS Chemex processes most of the samples generated in Chile and Argentina at its center in La Serena; and SGS, among others.

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Competition is tough in the geochemical area and companies need to maximize the value of the services offered. For ALS Laboratory, that is achieved through “a superior Laboratory Information Management System (LIMS) and state of the art analytical technology,” said vice president for South America Ángel Rodríguez.

SGS, for its part, goes beyond the exploration-focused tests to become involved in quality control across the whole mineral production process. Marcelo Ramírez, managing director of SGS Chile, explains: “Our main activities for the mining sector have been stretching along the whole value chain. Mineral processing is our core business in Chile. We have pilot plants for flotation, hydrometallurgy and grinding, and also we offer the QEMSCAN technology for automated microscopy. In Chile, the focus is not on exploration as in Brazil, Mexico or Peru, but on expansion projects. Every year new projects go beyond the exploration stage and move into pre-feasibility.”

Partnerships and Packages

The partnership model Dagnino was speaking about for contracting drilling rigs is also applicable to subsequent stages of mining production. One interesting strategic alliance has been the one between Xstrata Copper, engineering giant Bechtel and mineral processing equipment supplier FLSmidth Minerals, for the development of six copper plants in different countries. Waldo Valenzuela, general manager of FLSmidth Minerals in Chile, explains the advantage of this business model. “We can offer a complete package of products so clients can shorten project execution times as they reduce the period dedicated to engineering. Instead of quoting product after product, clients can work with a plant layout already well defined and gain valuable months as a result. We have done this for Centenario Copper’s Franke project in Chile and for Southern Copper’s Tía María in Peru.”

Valenzuela affirms that among the Chilean providers to the mining sector are very prestigious firms with world-class quality standards, and that the market is extremely competitive. “All these companies, including ourselves, have raised the bar to excellent levels of quality. What we need to explore is how we can be better than the others, leaving the price aside.

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Very often, this means improving the delivery time or providing the best integral solution for the customer.”

“Clients want to concentrate on their core businesses and activities, and for that they urgently need partners to develop the complete life cycle of their projects,” according to Héctor Andrade, manager of industrial solutions at Siemens in Chile.

That is why, in these times of enormous demand, having close ties with key clients is as important as the products and technologies themselves. ThyssenKrupp Ingeniería, a subsidiary of German-based ThyssenKrupp Fördertechnik that is introducing a new, high-pressure grinding mill (a technological breakthrough, according to company sources, due to its savings on energy and investment costs), also want to ensure that their long-standing customers come first: “Today one is often in a position to say we are not able to bid because of being overloaded. However, with key accounts, you simply cannot afford to do this. They must take precedence over other accounts,” said Martin Brenner, general manager, ThyssenKrupp Ingeniería.

As a mining country, Chile is one of the best places in the region (if not the best) to find the right partners. This level

of development has led, many agree, to the creation of a true mining cluster.

Already in Place

“The cluster does not exist on paper, it exists in reality. In Chile you will find everything,” said Ricardo Garib, South American managing director of Weir Minerals, a company involved in the mill sequence through the manufacture of pumps, valves and cyclones among other products.

Part of Glasgow-based Weir Group, the company has evolved to providing service and support programs, with its manufacturing unit in Santiago and service centres in five other locations around the country. “Our philosophy is to have operating plants very close to where our clients are located.” In South America, that means mainly Brazil and, of course, Chile. Despite the examples aforementioned, Garib laments that the partnership concept should be much more developed in the Chilean mining sector. “While Australia, Canada and other clusters prefer to buy products from their local suppliers, this loyalty has not been seen in Chile as of yet. When it does happen it is because of delivery and opportunity—not sincerity. And mining companies always push for lower prices, arguing that they can get the

same products elsewhere. Aprimin is trying to create a system where the supply industry doesn't work without the mines, and the mines do not work without the supply industry."

Weir Minerals, together with Komatsu, Finning, Atlas Copco and 45 other big companies, is part of Aprimin, an association created to defend the interests of large providers to major mining companies. Yet, in the Chilean mining marketplace there are hundreds of smaller players that are essential for the development of the industry. It was with the aim of representing them that another association called Sutmin was created during 2008.

One of the founding members of the new association is Tecpromin, a company involved in the mineral processing stage and that represents foreign brands such as Summit Valley Field, while it also manufactures its own equipment. With about 40 employees (half of them engineers), an office in Argentina and growing sales in Peru, the company is a good example of how SMEs in the Chilean mining sector can take their services and expertise beyond the Chilean border.

Juan Carlos Michels, general manager of Tecpromin, is happy to see the smaller



Atlas Copco equipment at Antofagasta Minerals' Michilla mine.

players in the sector structure themselves under the umbrella of an association. "I believe that Sutmin will be a very powerful tool for us in the future. In the frame of the organization we should see some changes in the relationship that companies like ours have with the major producers."

For big and small players, one of the main successes of the services sector in Chile has actually been the openness of the market and the tough competition on

all fronts, as well as the world-class quality standards demanded by the mining clients. This competitive environment has made everyone rack their brains and push innovation further. And even though miners are generally conservative people ("everyone wants to be the first second to try something new," said Felipe Viguera, general manager of Outotec), Chile has seen the introduction of major innovative products and technologies.

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As the mining industry changes, the mining cluster must evolve as well, and one of the great transformations that Chile will see in the medium and long terms is the sharp increase in underground mining activities.

The Underground Era

The new mine level at El Teniente and the underground operation below the Chuquicamata open pit are the flagship examples of the investments in underground that will take place in the next few years. Apart from Codelco, other majors are also analysing this possibility for their producing assets. If these projects go ahead, the challenge of transforming an industry generally used to open-air mining operations (with the obvious exception of El Teniente) will be enormous.

Yet companies are already working on it. Atlas Copco, as mentioned before, is researching the machines that Codelco will need at Chuquicamata underground. Soletanche Bachy, a French-based contractor specialized in tunnelling and underground exploration, affirms it is considering incorporating a tunnel boring machine (TBM) business in Chile in the future. And 3M, a company offering a wide range of products for mining operations and strong in solutions for electro-winning plants, is developing a new concept called 'The Miner of the Future.' "It is all about reducing the amount of gadgets and equipment that a miner has to bring with him when he goes underground," said Hernán Conejeros, manager of mining business development at 3M.

Other contractors such as Mas Errázuriz and Züblin are also seeing their underground-focused business grow. Mas Errázuriz, a Chilean company founded in the early 1980s, and with permanent bases in both Chile and Peru, has extensive tunnelling experience in the mining sector. The company is doing work for Codelco at Chuquicamata and El Teniente (where it is preparing the Esmeralda section for production); for BHP at Escondida; for Anglo American at Los Bronces and Collahuasi; and for Centenario Copper at Franke, besides working as a mining contractor at Atakama Kozan, a mine controlled by Japanese company Nittetsu. In Peru, the company's main mining customer is Doe Run.

Asked about the prospects for the company, Jorge Mas, president of Mas Errázuriz, said: "We are going to keep focused on our current business lines: mining underground work and construction. We should improve our position in the hydro-power sector however, especially in Chile, and we are studying the possibility of setting up branches in other countries, notably Colombia."

With regards to Züblin, a German-based construction company with more than 100 years of existence in Europe, it entered the mining sector in Chile in 1999 at Codelco's El Teniente, and since then has completed 150 km of tunnels for this operation. The company now has contracts with Freeport-McMoRan for the extraction of the mineral at Candelaria and Alcaparrosa (Ojos del Salado) mines.

Michael Weinhold, business development manager of Züblin, comments on how the company has adapted to the strict quality and safety standards demanded for by the mining producers: "For the last couple of years, mining companies are asking for certain certifications, and not having those we would have been in a disadvantaged position against our competitors. We wanted to have an edge, and were one of the first mining contractors in Chile to obtain all three certifications: ISO 9001, ISO 14001 and OHSAS 18001." Züblin's general manager, Miguel Menzel, said: "We

have focused our business mainly as a mining contractor and we think we are on the right path to becoming a strategic and reliable partner for mining companies in South America.”

Underground construction in Chile presents one particular challenge: the country's seismic activity with frequent quakes. In order to tackle this issue, DSI-Soprofint, a company specialized in fortification products, developed its Saferock system together with steel manufacturer Gerdau Aza and the University of La Serena.

Previously a family-owned company and now part of multinational group DSI, Soprofint manufactures its products in Chile and exports them to the whole region. The aim of the company now is further internationalization, with Peru and Brazil as the initial pillars of that strategy. According to Carlos Leigh, general manager of DSI-Soprofint, “Unlike in developed countries, the mining sector can grow by 15%, 20% or 25% annually in Latin America. We are now active in 75% of the countries in this region, from Panama to Chile, and our aim is to be present in 100% of them. There is huge potential in mining and other sectors involving tunnelling.”

More Construction

Leaving underground mining aside, the mining sector needs the support of the country's large construction firms like SalfaCorp and Sigdo Koppers, while other international companies such as Skanska are increasingly targeting the country's mining industry. Indeed, the size of the mining projects potentially suffices to fully book the capacity of these companies. “The Phase IV contract for Escondida was for 11 million man hours and Sigdo Koppers has a capacity to provide 12-14 million man hours annually. It was an important challenge for us,” said Cristián Brinck, general manager of Sigdo Koppers Ingeniería y Construcción.

These Chilean construction companies have grown their mining businesses working together with the international engineering firms, who use Santiago as their main location regionally (see following article). Sigdo Koppers, for instance, has a partnership with Bechtel, with whom it has developed 12 contracts in the last 15 years approximately; and SalfaCorp has also taken advantage of its relationships with engineering companies to undertake work outside Chile.

In such a human capital-intensive business, safety and productivity are paramount for companies. While Chile has probably the most stringent safety standards in the region, some companies involved in the mining sector complain that the labor regulations have become a bit too strict. For Jorge Mas (Mas Errázuriz), “The labor framework has become so rigid in Chile that it often goes against the interest of the workers themselves, while employers need significantly more people for the same size of projects.” Roberto Morrison, general manager of Soletanche Bachy, said, “Having too many people in the operation dilutes the responsibilities of each worker and results in more trips to the site, which increases the risk of traffic accidents.”

Brinck (Sigdo Koppers) agrees that productivity per worker has decreased over recent years in the country, and points at another challenge for construction companies: “The industry is today managed under the fast-track principle due to financing constraints. The client contracts the basic engineering in parallel with the concept engineering, the detailed engineering and even the construction. Construction needs to start before the plans have been prepared. For us this is very challenging because we need to quote services with very little information on how the final construction

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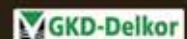
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will be realized. As constructors, our risk has significantly augmented."

Despite the risks, Chilean construction companies working for the mining industry seem very healthily positioned, not only at the Chilean level but also with regard to opportunities abroad. "Chilean companies in the services sector have a very good reputation overseas," said Francisco Javier Garcés, general manager of SalfaCorp. "We are an open country where foreign competitors can come and do their business in a free market environment. Our advantage is that, being a Chilean company, we have worked directly with the main engineering houses that have their Latin American headquarters in Santiago. That has helped us a lot to enter ventures abroad."

SalfaCorp, a large construction company present in Chile for 79 years and with sales of \$1.1 billion in 2007, serves the mining sector through project construction, tunnelling and maintenance, while it also has a subsidiary, Revesol, that manufactures products for the material handling process. In the past, SalfaCorp has been involved in work for BHP at Spence and Codelco at Gaby and El Teniente; the main projects for the

company today are Codelco's Andina division and Teck's Andacollo operation.

Mining represents 25% of SalfaCorp's sales; Garcés underlines the dynamic that this industry has given to the company's business. "Our clients increasingly demand more comprehensive services, especially in the mining business: this trend is pushing us to develop other areas such as maintenance, to give the mining company a complete solution that will allow them to own the operation and have contractors running it for them."

The Energy Crisis

The shortage of power that Chile has been suffering from in the last years is an area of concern for mining companies, many of which are located in the north, in districts of low population density and far from the main power distribution areas. To respond to the urgent demands of the industry, a number of companies in different segments of the power business are specifically offering their services to the mines.

The question is not just about the amount of power available in the country, but also about the related infrastructure needed to take it to where it is needed, explained Andrés Kuhlmann, CEO of

transmission company Transelec. "The sector is heavily focused on generation today, but let us not forget transmission. If we don't build systemic solutions for transmission assets, we will have solved the generation problem only to find that we have another crisis related to transmission. We need to focus on long-term solutions for the energy business."

For this reason the company, that already owns 98% of the transmission lines in the Central Interconnected System (SIC) plans to invest \$1.3 billion on assets in the next five years; of this amount, approximately \$360 million are expected to be spent in transmission solutions for mining customers. "I think 2009 is going to be the last year of severe shortages, at least in the central system," Kuhlmann said.

Another company that is targeting mining as a growth driver is Cam, a subsidiary of Spain-based multinational Endesa, offering energy efficiency solutions and power installation projects. The company has recently been restructured to better serve its mining customers, among which is BHP's Spence operation. Cam's General Manager, Gonzalo Mardones, underlines the quali-




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ty jump that service providers need to make to work together with mining clients: “Our target companies are Codelco, Antofagasta Minerals, Anglo American, BHP and Xstrata among others. But to deal with them we have had to improve all our processes, quality management and safety standards.”

Chilean Attractiveness

Mardones’ comments are just another example of how the highly developed Chilean mining industry and the openness of the market are pushing goods and service providers towards excellence. The mining community worldwide knows that a company with an established presence in Chile needs to comply with high standards and this continual pursuit of quality makes Chilean providers very appealing for international companies eager to expand in Latin America.

“We have worked on approximately 15 transactions over the last year involving service companies to the mining industry,” said Colin Becker, partner at PricewaterhouseCoopers in Santiago. “There is always a constant interest in acquiring service industries in Chile from international companies, with a view to




Christensen's plant in Quilicura, Santiago. (Photo courtesy of Rory Sheldon)

not only servicing the local producers, but also to expanding those services into other countries like Peru and Argentina.”

Asked about the future of the sector, Becker assures that Chile will remain one of the most efficient mining countries in the world, and that one of the greatest opportunities in the years to come will be

“the exportation of knowledge, services, and products to its neighbouring countries.” The cluster is already doing just that, and the mining industries in countries like Peru and Mexico keep growing very rapidly. In this context, the prospects for Chilean providers of goods and services could hardly be more exciting.



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Bechtel, Fluor, Aker Solutions, AMEC and others count their Chilean staff by the hundreds, and due to the size of expansion projects, can sometimes dedicate 200 to 300 people to one single account. The level of engineering skills devoted to mining in Santiago is invaluable, and due to the tough competition, very hard to hire and keep as well.

In this context, it is interesting to note that companies are increasingly working as partners with their mining clients. Perhaps the best example is the 10-year contract that Bechtel signed with Xstrata in late 2007, and that covers all of Xstrata's copper projects worldwide.

"This agreement is beneficial for both Xstrata and Bechtel. It gives us the benefit of assured work with a key client, and it gives them the benefit of having a dedicated engineering and construction company with uniquely broad experience supporting a substantial part of their business. Our current focus is on developing a standard plant design that will be applicable to all of Xstrata's copper porphyry projects. This will allow us to reduce services hours, capital costs, execution risk, lead time, and complexity," said Paige Wilson, South American general manager, Bechtel-Mining and Metals.

Besides the work for Xstrata, the company is also undertaking expansions for Los Pelambres (Antofagasta Minerals), Los Bronces (Anglo American) and Andina (Codelco). Chile represents 40% of the sales for Bechtel's M&M division worldwide. "If you were to add up all copper concen-



The conveyor galleries at El Abra are a prime example of the engineering required by modern mining operations.

trators and mines, Bechtel has been responsible for well over 50% of the copper mining industry's expansion in Chile over the past 10 to 15 years," said Wilson.

Chile also has an enormous importance for other engineering firms. Fluor and AMEC's Santiago offices are the largest of their respective mining and metals divisions by number of employees. Aker Solutions has its global head office of metals in Chile; and both Aker Solutions and SNC Lavalin have in their Chilean branches their main center of excellence for copper expertise worldwide—the latter company has 60 people from its Santiago office supporting copper-related projects in different parts of the world.

For these multinationals, being able to move their people according to the company's needs is just one of the advantages of having a global presence, according to Alejandro Sepúlveda, South American general manager at Fluor-Mining and Metals. "This corporate support is visible in areas such as purchasing," said Sepúlveda. "We have a global purchasing office in Houston and we have agreements with most of the largest suppliers which gives us access to some markets where small engineering companies cannot afford to operate."

Sepúlveda said that what Fluor sells is "successful projects completed within budget and schedule," but warns of the

challenge of achieving that primary objective in times of high demand. "We need to be careful in 2009 because within this very aggressive market, availability of resources is becoming a very serious issue," said Sepúlveda. "For this reason, we need to assure ourselves that as we take on new projects we are capable of meeting our commitments."

Indeed, some of the mining expansions mentioned are multi-billion EPCM projects, and the mining houses need to be sure of the competencies of their engineering contractor. Building the image of a large, reliable engineering partner is not an easy task and takes at least the successful completion of a big project, said Dave Lawson, president, Aker Solutions Chile. "A few years ago we made a strategic decision to go after the larger assignments, one of which was El Tesoro, a \$200 million project, which we completed in 2000 for Antofagasta Minerals," said Lawson. "It was hugely successful and its completion established our credibility as a company capable of undertaking large projects."

Lawson assures that the success at El Tesoro led to Aker Solutions winning larger contracts with Spence (a \$1 billion greenfield project completed for BHP Billiton in 2006) and Antofagasta Minerals' Esperanza, another large start-up project which is today Aker Solutions'



Luis Garrido, vice president operations South America, AMEC.



Ricardo Nicolau, CEO of JRI Ingeniería.



Carlos Andrade, general manager Chile, and John Busbridge, president South America, Golder Associates.

most important account and includes the processing plant, the concentrate pipeline and the port.

More Options for EPCMs

While El Tesoro was an important milestone for Aker Solutions, the EPCM at Andacollo (Teck) has been a relevant achievement for London-based AMEC, according to the company's VP Operations for South America Luis Garrido: "Andacollo has positioned us very well in the local market and in South America, bringing us other important business opportunities both in Chile and Peru, such as the EPCM for Centenario Copper's Franke project."

These projects have required important staffing efforts by AMEC. If in 2006 the company had 56 people in Chile, in 2008 this figure was over 600. Apart from those recruits (the result of organic growth) a further 550 people were integrated to the company with AMEC's acquisition of Chilean engineering firm CADE-IDEPE in late 2007, now part of AMEC's power and process division.

"From being AMEC's smallest mining and metals office, we are now the largest one," said Garrido. He spoke of the challenge of training new employees and creating a high-performance culture. "The freedom we promote is a key factor for our

employees to be happy, particularly today when there is a high demand for professionals," said Garrido. "One of our corporate achievements is that we show one of the lowest turnover rates of the industry."

Like AMEC, other companies are increasingly targeting big EPCM contracts. One of them is Hatch: "We are positioning ourselves now within the large EPCM business, and it is the best time for it. Considering the amount of projects in the market, I do not believe one company will be able to handle them all," said Leonardo Hermosilla, until very recently regional director of Hatch, Mining and Mineral Processing.



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The Canadian company, that has celebrated its tenth anniversary in Santiago this year, presents Candelaria (Freeport-McMoRan) as one of its main EPCM achievements: "We finished an EPCM project for Candelaria and upon its successful completion our image across the mining sector in Chile was significantly consolidated."

Hatch has expanded in Chile not just in size, but also with regards to the services they offer. "Until last year, we focused solely on the engineering of the plants, but we are going to expand into the mining side of the operation. It is now our time to be in the mining business," said Hermosilla.

Chilean Expertise

The mining-related expertise developed by Chilean engineers has acted as a magnet for international firms, many of whom entered the country acquiring a local company directly. That's the case, among others, of Canadian SNC Lavalin, who bought ByR Ingeniería and Arcadis from the Netherlands, who took over Geotécnica Consultores in 1997. More recently Australia-based Sinclair Knight Merz (SKM), who had an office in Chile since 2000, purchased Minmetal in 2005.



Freeport-McMoRan operates El Abra, Ojos del Salado and Candelaria (pictured) in Chile.

Today, SKM has close to 900 people in Santiago and 95% of its sales in Chile come from work for the mining industry. Clients include BHP Billiton, Codelco and Antofagasta Minerals at Esperanza, where the company works in partnership with Aker Solutions. While maintaining this extensive expertise gained with a few core customers (the company has a target to

gain 80% of its work from 20% of its clients), SKM is bringing skills from other parts in the world to develop its water & environment and power divisions.

"We feel these other businesses closely complement our mining business and allow us to offer total solutions to our customers. We see significant activity in these areas now and in the future in Chile, and more broadly across South America. We have an M&A program and plan to expand our operations to include offices in Peru and Brazil," said Glenn Tonkin, managing South America, SKM.

Another player aiming at pursuing its internationalization is JRI Ingeniería, a 100% Chilean-owned company started in 1982 that has been involved in projects such as the molybdenum plant at Escondida and the tailings disposal system at Los Pelambres, as well as assignments in other countries. The company has grown rapidly over the last couple of years, from 150 employees in early 2007 to about 230 today.

As a Chilean company, JRI knows very well the problem posed by the lack of water in the north of the country, said the company's CEO, Ricardo Nicolau. "We are doing a lot of work with new paste thickening technology." The important part about this technology is that you can reclaim more water out of your tailings, which is very important in the north, and is more environmentally friendly, because water contained in thicker tailings paste is less likely to seep into underground water reservoirs and contaminate them."

Paste thickening technology is also a speciality of Golder Associates, an engi-

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neering firm centered on providing consultancy services and specific engineering jobs rather than EPCMs. As a global employee-owned organization, the company tries to ensure that resources are moved easily to the locations that need them most, explained John Busbridge, president of Golder Associates South America. "A shareholder's return in Golder is totally dependent on the global performance of the company, so there is no disincentive to using the best professional from anywhere in the world to work in a project."

Golder works across several areas, from ore evaluation services and geotechnical engineering to water management and environmental tasks, while trying to be highly specialized in each of them. For Carlos Andrade, general manager, Golder Associates' Santiago office, that puts the company in a healthy position for the future. "We are pretty well diversified across mining services. In the next years, mine closure plans will be a very important area. Then, as big mines in Chile go deeper and deeper, there will be a whole new area of work created by new geo-mechanical problems."

Finally, another consultancy-focused company that also wants to serve the mining client from the exploration stage to mine closure is SRK Consulting, which has its Latin American offices in Belo Horizonte for Brazil and Santiago for the rest of South America.

Alejandro Palma, general manager, SRK Consulting, underlines the salience of the environmental work in the current mining scenario, even though the company has an integrating concept of all disciplines: "The environmental standards have changed dramatically in Chile in the last few years," said Palma. "Today, we have the same requirements as other countries such as the U.S., Australia or Germany."

Luckily for the mining companies, the engineering firms that can assist them, either with environmental consulting, specific engineering jobs or large EPCM projects, are all in Santiago. They are mostly international corporations who have grown their Chilean base to be one of the largest offices (if not the largest) of their global structure for mining and metals. They are certainly very busy at the moment, and together with many other goods and services providers, there is no doubt that they will maintain an essential role as great contributors to the development of the mining industry in Chile.



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(Opportunities for Mid-Tier Companies - from p. 81)

without most of its juniors," said Albrecht Schneider, general manager of Andina Minerals in Chile.

Schneider also explained why Chile, being a large gold producer, has very few juniors active in the country. "The reason has nothing to do with the potential of Chile as compared to other countries, but is related to the cyclical nature of gold exploration," Schneider said. "Peru attracted many juniors after the successes at Yanacocha, Pierina and Alto Chicama. But let us be fair, after these no juniors have found any large deposits in the country and Peru is proving socially and environmentally difficult. For these matters Chile is far ahead of Peru. Juniors follow the trail of discovery and move to the areas that will attract funds more easily, and the Peruvian story was surely very nice."

Andina Minerals, a company headquartered in Toronto and listed in the TSX-V, has in its 100%-owned Volcan property its flagship project. Located in the Maricunga gold

belt, the deposit currently has 6.6 million oz of gold (measured and indicated, grade 0.85 g/mt) plus 2.8 million oz gold (inferred, grade 0.9 g/mt). In May 2008, Andina, who plan a heap leach operation at Volcan, completed the acquisition of water rights for the project.

Andina has another two projects in the country: Pampa Buenos Aires, a 50:50 joint venture with Iron Creek, and Encrucijada, where Hochschild Mining can earn up to 60%.

Also in the Maricunga belt is gold-and-copper Caspiche, one of the main projects by Exeter Resource. Since October, this company, also headquartered in Canada, has undertaken a new drilling campaign on the property of 9,300 meters, which is already a revised figure due to the global financial crisis. If market conditions improve, the company can expand the program to extend to 15,000 meters, it said in a press release. A 43-101 inferred resource estimate is expected for Q2 2009.

The other focus of the company (the Cerro Moro project) is in Argentina, a coun-

try that presents a different picture from Chile as Exeter's COO, Paul Cholakov, notes: "Argentina presents more opportunities for juniors because the market is not dominated by the majors as in Chile. However, for the same type of project things probably move faster in Chile and the services industry is highly developed. For North American companies, Chile is definitely a comfortably country to work in."

Now, we may have entered another negative cycle for juniors like the one Schneider was mentioning before. The natural resources-related industries need to overcome the financial crisis and the challenges presented by lower commodity prices. For exploration companies, rising funds is far tougher today than it has been for a number of years. In this context, Chile has a priceless advantage: it presents those companies with the stability needed to advance their projects faster than in other jurisdictions, and the reassurance that the mining regime will not change overnight. In other words, years of efforts and millions of dollars worth of investment will not be wasted.



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