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CHILE MINING 2024



Copper - Lithium Triangle - Climate Change Adaptation
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Consejo Minero is a trade association that brings together the largest mining companies operating in Chile. We drive competitive and sustainable development for the Chilean mining industry thus contributing to our country's growth.



We bring mining closer to people letting them know its reality, challenges, and contributions in a transparent manner. We collaborate in the process of drafting modern, efficient, and stable public policies that will eventually govern the mining industry of the future and its environment. Furthermore, we help overcome sectoral challenges associated with human capital and water resources, among others.

Visit consejominero.cl to obtain updated figures and relevant information regarding the Chilean mining industry.



Dear Readers,

As the climate crisis deepens, Chile finds itself at a pivotal moment in its mining history. Enjoying a long reign as the world's top producer of copper, Chile is also the second-largest producer of lithium, and thus the country is crucial for the global shift to a green energy economy. In 2024, copper has taken center stage, achieving historic highs and electrifying excitement into the Chilean mining sector.

Chile's mining industry has felt the effects of the changing climate, facing severe climate-related challenges including droughts, abnormal rainfall, and cold spells, which have intermittently halted mining operations. Yet, Chilean miners have shown remarkable resilience in overcoming these obstacles, and are setting global precedents using technological and innovative solutions.

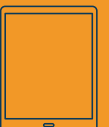
Chile's path forward is built on centuries of mining expertise, and the current challenges create a fertile ground for these technological advancements, revitalizing a sector that had slowed due to political debates over constitutional and permitting reforms. Now, with favorable global economic conditions, the stage is set for a resurgence.

Chile's miners, engineers, geologists, chemists, and builders are preparing for this revival. After conducting over 150 interviews with industry leaders, GBR presents a thorough overview of the sector. We extend our gratitude to the Ministry of Mining, Consejo Minero, APRIMIN, and the many executives and leaders who shared their valuable insights with us. We hope that the information and opinions contained in this report will help all stakeholders involved in the global mining value chain to gain a real understanding of Chile's mining sector. Enjoy the read.



Alfonso Tejerina
 Director and General Manager
 Global Business Reports

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Introduction

“

Chile has prepared itself for 40 years for the present moment. The country has the necessary miners, metallurgists, engineers, automation, knowledge, worldwide experience and instrumentation to support increased mining activity.

”

Mauricio Mazuela
General Manager
HITACHI ENERGY

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The Chilean Mining Renaissance

A year of revival for the sector

“The copper there asleep. These are the desolate northern hills... the arteries of the dormant volcano, the vein is found, drilled, and dynamite explodes, the rock spills, it is purified: copper is born.”

These are the words of the Chilean Noble Prize Literature laureate Pablo Neruda. 51 years after his death, the industry stands at the threshold of an evolutionary era and, with the green energy transition in full swing, the time has come to wake up the dormant copper Neruda describes.

In 2023, the industry navigated through a period of considerable legal turbulence and transformative change; the long-debated royalty reform was approved, and the con-

stitutional developments set a new precedent, reshaping the legislative landscape that underpins the sector. 2024 was marked by a transformative beginning, as on January 1st, the amendments to Law No. 21,420, refined by Law No. 21,649, came into effect. These revisions represented the first major update to Chile’s mining regulatory framework since 1983, ushering in a new era of industry regulation.

From 2023 to 2032, the Chilean mining investment portfolio comprises of 49 projects, totaling an investment of US\$65.71 billion, according to the Chilean Copper Commission (Cochilco). Six of these projects successfully concluded in 2023, with a cumulative investment of US\$7.77 billion. A highlight among those is Vancouver-based producer Teck Resources completed ramp up of its Quebrada Blanca (QB) mine expansion. In Q1 2024, production jumped 74%, amounting to 99,000 t, with QB responsible for 43,300 t of that total. The firm’s full-year copper production for 2024 is predicted between 465,000 t and 540,000 t, well above the 296,500 t produced in 2023.

Six new projects, amounting to US\$6.31 billion, were included in the total, showing the growth of the industry. State-owned Codelco increased its budget by US\$4.38 billion for the implementation of both operational and structural projects. In the private sector, investment increased by US\$2.33 billion.

The US\$65.71 billion investment portfolio is, however, a significant US\$7.94 billion drop from the 2022-2031 period. Dominique Viera, president of APRIMIN, explained: “In the context of investment, it encompasses far more than just obtaining permits; it is about fostering an environment conducive to investment. In terms of permits, there are numerous actions we can undertake to expedite the process without necessitating new legislation. For instance, simplifying the accreditation of teams and streamlining the approval for exceptional shifts can significantly reduce waiting times.”

The government is determined to be proactive. “There is an explicit commitment from the government to reduce permit processing times for mining investment projects in Chile by a third,” said Minister of Mining Aurora Williams.

Under the Mining Royalty Law, the government created a public-private working group that proposed 20 actionable measures aligned with this goal. These moves come at a critical time. Copper is trading at its highest levels. International firms perceive current copper prices and Chile as the perfect marriage. CEO Martin Kostuik of US-based Battery Mineral Resources, that operationalized its new Punitaqui

mine in Chile in 2024, explained: “Our commitment to investing in Punitaqui and bringing it into production reflects our confidence in the future of copper.”

Lithium: the horses are in the gate

Chile is the world’s second-largest producer of lithium. Following the lithium boom of 2022, governmental debates stalled further growth in the industry. The delay came with reason, explained Minister Williams: “Rather than focusing on production numbers or a global position, we aim to develop responsible mining that enables the state to capture revenue, incorporating technology and including Chilean talent. If this places us firsts in terms of global production, that’s excellent. However, our primary goal is to develop lithium ethically and sustainably.”

In 2024, the government classified Chile’s 69 saline environments, identifying 26 salt flats open exclusively to private investors. On April 15th, the country announced a Request for Information (RFI) process. Results were announced on July 9th; 88 applications were submitted from companies based in 10 countries.

Collaboration is key

Collaboration plays a fundamental role in addressing the mining industry’s future challenges, according to Andrés Souper, general manager at Glencore Chile: “Collaboration and strategic alliances to exchange knowledge, technologies, and resources specific to the mining industry, both nationally and internationally will be the primary method to meet the impending copper shortage.”

Iván Arriagada, CEO of Antofagasta Minerals echoed the sentiment, having signed a collaborative agreement with Codelco in December 2023: “Both companies seek to share best practices in more sustainable mining by working together on the key challenges facing the industry and its production processes, such as the growing demand for copper to enable the global energy transition.”

The year has begun with some of the most significant collaborative, and general, moves the copper industry has seen in years. On April 16th, 2024, Australia-based BHP made its first all-share offer for Anglo American, originally valuing the company at US\$38.9 billion. Anglo American rejected three unsolicited, non-binding and highly conditional takeover proposals.

On the exploration front, collaboration is the key to unlocking a greenfield pipeline said Christian Barra Llano, general manager at Orbit Garant: “It would also be beneficial to promote collaboration between mining companies to standardize operational and safety requirements, like in Québec. This would simplify accreditation processes and reduce costs, allowing a quicker start to new projects.”

The Chilean mining industry is not without challenges. An estimated 34,000 skilled workers are needed to meet the supply gap caused by the energy transition, but the number of people entering the industry dwindles. Liquidity for juniors is at an all-time low, while the pressure to make discoveries is at an all-time high. Global lead times to bring mines into production continue to lengthen. Productivity bottlenecks are hampering Chile’s production goals. The impacts of climate change accelerate, yet miners are forced to mine more and mitigate their impacts simultaneously. Chilean miners are striving to find the way forward for Chile and the general industry. In many respects they have been successful, reviving the sector, and helping to redefine the future of the industry. The succeeding pages serve to reveal a part of those efforts. ■



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Aurora Williams

Minister of Mining
GOVERNMENT OF CHILE

“ We are committed to improving permit times and procedures, hence expediting and strengthening our national mining industry. ”

What are the main differences in the Chilean mining industry today compared to the last time you were minister in 2018?

Between 2018 and 2024, contexts have changed, more so than mining itself. This period was marked by the pandemic, increased social demands, and two constitutional processes. The mining industry has also evolved with the implementation of a new Royalty regulation. This legislation, which was debated for several years, is now fully in force and is already generating tangible benefits for communities. On April 12th, 2024, the government distributed CLP93 billion from the Royalty Regulation to 307 municipalities.

How is the government addressing productivity in the sector?

The way that we have faced decreasing ore grades has been a great demonstration of Chilean engineers and professionals' value and expertise. After 115 years of operations, 110 of those as an open-pit mine, Chuquicamata was transformed into an underground mine. The goal is for it to run for another 100 years. This shift is a world-class engineering transformation, proving Chilean resilience and ability to face big challenges.

Another of these challenges is the need for integrating technology to enhance productivity and reduce costs. Technology is a key enabler to the development of the mining sector, especially when it comes to safety, and this sometimes implies higher costs.

How is the Chilean government working to support the junior exploration sector?

At the end of 2023, Chile ranked fourth globally as a principal destination for exploration investment, and first in Latin America. We need the State to improve the fluidity of project evaluations, shortening timelines without compromising socio-environmental standards. There is an explicit commitment from the government to reduce permit processing times for mining investment projects in Chile by a third. We are materializing this commitment through two bills, both presented in January 2024. The first one amends the base environmental law; the second, seeks to change non-environmental sectoral permits. As a result of the Royalty regulation, we established a task force with various actors from the industry, and from this space, we are constructing new legal norms.

Additionally, we have been working on amending the mining law. As a result, the timeframe for mining exploration has been extended from two years to four years, with the possibility of an extension to four more years. This is only one of the ways we're showing our commitment to promote continuous development for the mining industry.

Can you detail recent advancements in the lithium sector?

Rather than focusing on production

numbers or a global position, we aim to develop responsible mining that enables the State to capture revenue, incorporating technology and including Chilean talent. If this places us firsts in terms of global production, that's excellent. However, our primary goal is to develop lithium ethically and sustainably.

The Chilean government presented the National Lithium Strategy in 2023, after six months of dialogues and inputs from Indigenous communities in the four regions where the salt flats are located. This year, we worked to identify which salt flats should be studied for protection, and what are the needed protection levels. While there already was a protected group of salt flats, we are expanding this list by 25%. As a result, we found two salt flats that we think should have majority State participation: Atacama and Maricunga. There are some other salt flats where we foresee public participation, but with flexibility in the business model. This is the case with the Altoandino and Pedernales salt flats in the Atacama region.

For 26 salt flats, representing 18% of our national total, we opened a Request for Information (RFI) process on April 15, 2024. Through this, we are looking to understand what is the true interest for international investing and assess its potential impacts, conducting relevant indigenous consultations before moving forward with Special Operation Contracts for Lithium (CEOLs). We decided on this initiative after the earlier experience of a failed tender in 2021, where potential impacts were not accurately assessed, leading indigenous communities to defy the process.

Do you have a final message?

The commitment of the Chilean government is to develop the mining industry through public-private collaboration, maintaining a socio-environmental balance. With its experience, Chile is prepared to supply the critical minerals that global demand requires, thanks to its geological virtues and available human talent. As government, we are committed to improving permit times and procedures, hence expediting and strengthening our national mining industry. ■



Joaquín Villarino

Executive President
CONSEJO MINERO

“ Most of the uncertainties in the sector have been resolved. There is human capital to make mining possible, and stable institutions and transparency to give foreign investors peace of mind. ”

What recent developments in the Chilean mining sphere should investors be aware of?

2023 was a year of good news for the Chilean mining sector. The constitutional discussion was resolved, eliminating the prolonged uncertainty that had disrupted investment decisions. The passage of the royalty bill, previously a major source of uncertainty, has now made long-term investments more feasible. Finally, under the Ministry of Finance, a working group, collaborated to establish a roadmap to address inefficiencies in the permit system.

Today, Chile's mining environment is much more positive than in 2021 and 2022. This has led to declarations from large mining companies; AMSA invested US\$4 billion in a new concentrator at Centinela; there are expansion plans at Collahuasi; operations began at Quebrada Blanca II; Los Bronces expansion; Anglo American's project obtained its environmental approval resolution; and Codelco is also investing. For the next two years, there is an investment portfolio of approximately US\$18 billion. In the long term, that portfolio increases to US\$66 billion.

All of this contributes to a much more positive environment for investment nowadays.

What efforts are being made to streamline the permitting process in Chile?

Upon approval of the new royalty,

the government formed a working group under the Ministry of Finance, involving the Ministries of Economy, Mining, and Environment, with representatives from Sernageomin, Sonami, APRIMIN, and Consejo Minero. After six months of collaboration, the group produced two crucial documents: a baseline analysis identifying the permits with the longest processing times and the areas with delays in project permit acquisition, and a roadmap developed by the Ministry of Finance to address these inefficiencies and bottlenecks.

What plans must the country finalize to spur investment in the lithium space?

The country is making decisions that abandon the idea that only the state will exploit lithium reserves. The Ministry of Mining has issued a call for short-term investment proposals and identified the strategic and protected lithium-bearing salt flats. Now that the government has defined the rules of the game and eliminated the elements of uncertainty, investors are starting to make decisions.

The government defined the 26 salt flats, but they have not defined the formula for incorporating private companies, the timeline for when they will grant the contracts, or how they will incorporate the private sector with ENAMI and Codelco. We know the two companies that will be involved, but not the measures the government is undertaking to grant Spe-

cial Operation Contracts for Lithium (SEOLs). The industry needs a greater level of definition from the state, but lithium is acquiring velocity.

What role does Chilean mining play in addressing climate change?

Just as the country committed to achieving carbon neutrality by 2050, many mining companies have committed to reaching this by 2040. The greatest promoter of clean energy in the country is the mining industry, consuming one-third of the electrical energy. The wind and solar parks in northern Chile were financed by the mining sector. Today, renewable energies represent 68% of the supply for large-scale mining operations. By the end of the decade, this percentage will be around 80%. Mining also promotes the construction of desalinization plants. By the end of the decade, nearly 50% of water consumption in the mining industry in Chile will be seawater.

Climate change not only requires the mining industry to reduce its effects on the planet but also to adapt to the effects of a changing climate. Chile has felt the effects of climate change for years and has started to adapt. Tailings tanks, for example, have been engineered to withstand intense rainfall. Visible change obliges the industry to rethink its infrastructure.

How can the industry address the problem of the skilled labor shortage?

I would like to share two significant advancements on this topic. In March 2024, the total participation of women in mining companies reached 20.9%. Additionally, 1 out of every 2 individuals hired by mining companies in the last 12 months were women. This is a sector-wide commitment that has seen significant progress in recent years.

Do you have a final message?

Chile is a country with a long mining tradition. Most of the uncertainties in the sector have been resolved. There is human capital to make mining possible, and stable institutions and transparency to give foreign investors peace of mind. ■



Dominique Viera

President
APRIMIN

What does APRIMIN's 20th anniversary signify for the association?

Our inception aimed to amplify the visibility and value of providers throughout the mining supply chain. Celebrating 20 years is particularly monumental, highlighting our esteemed position and the prestigious partnerships we cultivated within the industry.

How is APRIMIN working to reduce the gender gap?

Unlike the rigid shift systems prevalent in direct mining operations, many suppliers boast more flexible working arrangements. This flexibility stems from the varied nature of our work, encompassing engineering firms, contractual roles, and more. Our workforce requirements extend beyond traditional mining roles to include professionals like doctors, journalists, lawyers, and others who support the mining industry's broader ecosystem. Many more employment opportunities can be found in service providers. In APRIMIN we have 28% female participation, which is indebted to the types of services we offer.

How can the industry attract new talent?

In Chile, nearly 50% of young people have no interest in working in mining. Our job is to inform young people, from an early age, what mining is. Chile is a mining country but does not have mining education in schools. This must change. Students must be encouraged to enter STEM fields and work in train-

“ Service providers, as specialized private companies, possess a unique advantage in identifying areas to enhance operations, particularly with environmental improvements in mind. ”

ing programs to be exposed to the benefits of working in the industry. Society and the state must realize a whole ecosystem benefits from mining activities, not just the miners themselves.

How is APRIMIN promoting sustainability?

Service providers, as specialized private companies, possess a unique advantage in identifying areas to enhance operations, particularly with environmental improvements in mind. We promote the application of an emission calculator to provide a baseline for the operations of our suppliers; without it, there is no way to improve. Many of our members are working towards net zero, and we are working together to help them achieve it.

What challenges is the Chilean mining industry facing and how can they be overcome?

According to Cochilco, Chile is expected to receive around US\$65.71 billion in mining investments, a drop from previous estimates, which, five years ago, anticipated around US\$70 billion. Productivity in Chile is also declining terribly. Suppliers, and APRIMIN, have a lot to bring to the table to solve these problems.

In terms of permits, there are numerous actions we can undertake to expedite the process without necessitating new legislation. For instance, simplifying the accreditation of teams and streamlining the approval for exceptional shifts can significantly reduce waiting times.

We have taken proactive steps towards improving efficiency, notably through our Productivity and Approval Committee. This committee is developing a system for the standardization of entry requirements for all mines, to shorten the time it takes for teams and companies to start operating on-site.

What is the state of technology adoption in Chile?

As suppliers, we are fundamentally driven by innovation and technology—it's the cornerstone of our value proposition. Without it, achieving world-class status, which we continuously strive for with our partners, would be unattainable.

Suppliers inherently have testing facilities, research and development centers, and brand protection mechanisms in place. In Chile, it is essential to give these innovation hubs greater visibility and support. They are the breeding grounds for the advancements we seek to standardize across the industry. While many of these centers are currently overseas due to regulatory and cost barriers, our goal is to facilitate a more conducive environment for them to establish directly in Chile. By doing so, we can foster a culture of innovation within the local mining sector, driving progress and maintaining our competitive edge on the global stage.

What are APRIMIN's goals?

APRIMIN's current initiatives focus on investment and productivity. Our goal is to foster a supportive environment for new investments in Chile, especially as we anticipate a significant surge in copper demand. International analysts predict a doubling of copper demand. However, there is concern about whether Chile's current productivity levels and output are sufficient to capitalize on this impending boom. APRIMIN is dedicated to collaborative efforts with key industry players such as Consejo Minero, the government, and various committees. We aim to prepare the mining industry to meet the rising demand efficiently. By enhancing productivity and attracting investment we strive to ensure that Chile remains a leading force in the global mining industry, ready to leverage the upcoming opportunities in copper and beyond. ■



Jorge Riesco

President
SONAMI

What are recent developments in the Chilean mining industry?

The inauguration of Teck's Quebrada II project in Tarapacá was a highlight, involving an unprecedented US\$8.6 billion investment and overcoming pandemic challenges, showcasing Chile's ability to execute major projects under adverse conditions. However, we also faced a general decline in copper production, prompting the need for increased efforts to generate and execute more projects.

The approval of the new mining royalty, while initially introducing uncertainty, has now provided clearer future tax conditions, aiding decision-making for new ventures. Despite this, obtaining and processing environmental and sectoral permits remains a significant challenge, affecting both new and ongoing projects. These concerns have been communicated to the authorities, and we hope to develop an agenda this year to resolve these issues.

What is Chile's position in the global copper sphere?

Instead of focusing on competitiveness, we should aim to surpass our current production levels. We have

the resources, people, knowledge, engineering, and means at our disposal. Growth is more crucial than revenue ambitions. For every 1 million t of fine copper produced, we estimated fiscal revenue of US\$1.35 billion when copper was below US\$4 per pound. With current prices, this could reach US\$2 billion per every 1 million t produced.

Chile holds nearly a third of the world's copper reserves and are expected to produce 35% of the global supply. This means we need to deliver 2 million more tons of fine copper, but we are currently aiming for only 1 million.

How has the lithium industry developed since the approval of the National Lithium Strategy?

The National Lithium Strategy is ineffective. The government has not provided a clear path, causing further delays and uncertainty. Only CORFO's leased concessions in the Atacama Salt Flats are producing lithium, showing that concessions explicitly including lithium are effective. Replicating this model elsewhere could streamline processes, as private companies would likely cooperate to advance projects due to high lithium prices. ■

Where does CRU's market data originate?

At CRU, we analyze over 50 mining commodities through primary research, not secondary sources. We have a global network of analysts, with offices in the US, China, Chile, Australia, London, and Singapore, and analysts in regions like South Korea, Brazil, and South Africa. This allows us to gather real-time information from various sources. In Chile, we operated for 18 years, evolving from consultancy to a strategic hub offering customer service, marketing, consultancy and sales. The dynamic Chilean workforce has been key to our growth. Primary research is our main differentiator. We recently partnered with Bloomberg as they value the independence and transparency of our data.

What is CRU's outlook on the copper supply deficit?

Our Long-Term Market Outlook, which provides a 10-year forecast of the market, predicts that, by 2034, the world will be in a 7.7 million t of refined copper deficit. Our projections consider the gradual decline of existing operations, all approved projects yet to

start, probable projects, and half of the speculative ones.

As seen at Cobre Panama, however, copper supply is subject to the world's increasingly complicated dynamics. Within a year, the copper deficit increased by 1 million t of refined copper. The impact of climate change has also had a major impact; for example, the Panama Canal faced droughts.

What role will Chile play in meeting copper demand?

Chile has the highest number of projects, with 70 in total, covering 51% of the missing tonnage, followed by the US.

What is Chile strategic positioning for meeting the global copper deficit?

It's not just about the deposits; it's about the culture. In Chile, new mining projects are viewed positively, seen as new employment opportunities, GDP growth, and increased government resources. This is not the case everywhere. For example, Panama's first large-scale mine faced significant opposition due to a lack of mining culture. ■



Renewable Energy and Mining

The perfect marriage

According to the World Bank's 'The Mineral Intensity of the Clean Energy Transition' report, an estimated 3 billion t of minerals and metals will be required by 2050 for the implementation of wind, solar, and geothermal energy, along with energy storage, to limit the effect of global warming to within the 2°C mark as defined in the Paris Agreement. Production of minerals, such as lithium, graphite and cobalt could increase 500% by 2050. Consumption of copper, on the other hand, will almost double to around 50 million t/y by 2035, according to S&P Global. However, the more ambitious the climate targets, the more minerals will be needed for a clean energy transition. "Chile is the world's largest producer of copper and second largest producer of lithium, contributing approximately 25% of the world's copper and a third of its lithium," said Mark Wainwright, managing director at Turner and Townsend.

The Chilean mining industry has the responsibility to supply the international market with the necessary minerals while containing its effects on the environment in doing so, which requires that the entire value chain makes decisive progress in the reduction of greenhouse gas emissions. "Especially with the climate change crisis, we must be not only a mining country, but also a country at the cutting edge of responsible, sustainable mining," President Gabriel Boric stated at the March 2024 inauguration of Antofagasta Minerals' US\$2 billion desalination plant for its flagship copper mine in Chile, Los Pelambres.

Energy generation is responsible for 77% of the country's emissions, according to the National Energy Policy, and the mining industry consumes 36% of this energy. To cut emissions, renewable energy will be a necessary alternative. However, mining is the enabler of the renewable energy sector, according to Minister of Mining, Aurora Williams: "A substantial number of mining operations in Chile are using renewable energies, which has enabled the development of significant energy projects in the north of the country. The mining industry accounts for about 30% of our national energy demand, especially in areas with resources like copper, lithium, and solar radiation—these synergies contribute to building a more sustainable mining industry."

Watts up in Chile?

The current energy matrix is robust, according to Sergio del Campo, president of Sonnedix Chile and former Minister of Energy: "The Chilean electricity market has approximately 12,000 MW of hybrid renewable energy, with 7,000 MW under construction, predominantly solar. By 2025,

this capacity is expected to reach approximately 19,000 MW, with 15,000 MW from solar sources."

Following its US\$556 million acquisition of a 416 MWp solar photovoltaic (PV) portfolio from Enel Chile in October 2023, Sonnedix became the country's third-largest renewable energy provider with over 2.5 GW of controlled capacity. Globally, this was the firm's biggest acquisition of operating assets to date. "Our portfolio in Chile stands as the largest within our global operations, reflecting the trust investors place in the Chilean electricity market. The country's macroeconomic stability and attractive regulatory framework are also key pillars for national and international investments," emphasized del Campo.

José Rodríguez Monje, general manager at Aggreko Chile echoed the sentiment: "Chile has been a pioneer in the renewable electricity market, and due to accessibility of renewable resources, the cost of energy is low in comparison to other jurisdictions."

Chile pledged carbon neutrality by 2050 under its 2022 Climate Change Framework Law. To further support the transition to renewables Chile passed the Electric Tariff Stabilization Law in April 2024 to mitigate electricity price hikes by providing subsidies, ensuring affordable and stable energy costs for consumers. Both laws work together to support Chile's transition to a low-carbon economy while protecting consumers from the financial impacts of this transition.

Short-circuiting Chile's renewable energy ambitions

In Chile, 70% of electricity is expected to come from renewables by 2030 and 96% by 2050. During the first trimester of 2024 renewable energy reached a record-breaking 41% of total electricity generation, according to the National Electric Coordinator. However, current permitting within the country may hinder its goals, according to María Teresa González Ramírez, country manager at Statkraft: "The current timelines for obtaining permits make it impossible to complete the necessary projects to replace coal. Current permit lead times can kill a project. Investments need certainty—if a permit is supposed to take six months, the state should confirm it in six months, not two years."

Statkraft's hydroelectric project in the Pilmaiquén River was delayed 2 years, costing the company an extra US\$50 million due to delays in obtaining an archaeological characterization permit from the National Monument Council. "The state, civil society, and the private sector must decide which projects are needed to replace coal. To replace the 5 GW of coal currently supporting the grid, the country needs to install 15 GW of renewable energy capacity," González continued.

Transmission infrastructure is another obstacle for the industry said del Campo: "Given Chile's elongated geography, building new transmission lines is challenging, especially due to environmental and land acquisition hurdles. The transmission system cannot keep up with the rapid adoption of renewable energies, as reflected in projects like Kimal-Lo Aguirre, which is already a year behind schedule."

Kimal-Lo Aguirre is a 1,342 km transmission line capable of transporting 3,000 MW from the country's north, where most renewable energy is generated, to Santiago, the country's capital.

"Energy storage is part of the solution to this situation," del Campo continued, "Minister Diego Pardow's energy transition plan emphasizes energy storage to address transmission system investment gaps and speed up transmission development. Therefore, several energy-generating companies are conducting analyses on energy storage technology, and there is a growing interest among potential customers in adopting this technology."

The BESS-t way forward

Energy storage solutions are the gateway to ubiquitous renewable energy use in the mining sector. "Large mining companies have such large energy demands, that they mainly acquire this energy through large Power Purchase Agreements (PPA). However, the backup plants of their critical processes can easily and quickly be changed to renewable energy sources," stated Rodríguez Monje, continuing: "The batteries are already offered on the market. We are in discussions for a project to implement a 4 or 5 MW capacity system. The project involves Battery Energy Storage Systems (BESS) technol-

ogy, which helps to manage variability and ensure a steady supply of electricity."

BESS are attractive in Chile said Francisco Caballero, business line manager power and light South America at Atlas Copco: "They can be portable, making them exceptionally innovative while eliminating fuel consumption, emissions, and reducing noise levels. This adaptability is particularly appealing given Chile's diverse geography, ranging from sea level to altitudes of almost 4,500 meters."

BESS technology is taking hold to make better use of the existing transmission infrastructure. In April 2024, the National Electricity Coordinator authorized the start of operations at the largest battery-based energy storage system in Latin America. This plant, named BESS Coya and owned by ENGIE Chile, has storage capacity of 638 MWh, with 139 MW of installed capacity. The plant will mitigate 65,642 t/y of CO2 emissions and uses lithium batteries to store renewable energy.

Lithium batteries, though, may not be the best option. "They only deliver energy for five hours," said Felipe Schneider, general manager at BASF. "BASF has a solution that allows continuous energy supply, which is a sodium-sulfur battery. They deliver energy for six-eight hours. During the day operations can be run with solar energy, and the supply can be maintained with our batteries during the night. Sodium and sulfur are both abundant elements and the batteries have a use life of 20 years, making them a perfect sustainable alternative" he continued.

Chile's path to a renewable energy future is fraught with challenges but equally filled with opportunities. By addressing regulatory inefficiencies and investing in advanced storage technologies, Chile can achieve its ambitious energy goals and set a precedent for other nations. ■

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“ Chile has been a pioneer in the electric market, and due to accessibility to renewable resources, the cost of energy is low in comparison to other jurisdictions. ”

José Rodríguez Monje

General Manager
AGGREKO CHILE

How were Aggreko's results during 2023?

In mining, Aggreko achieved 7% better results than projected. Concerning technology, we are starting to work hard on accompanying customers in decarbonization. We identified four clients for whom we can start providing storage technology, change solutions to hybrid ones, and change thermic operations to solar ones. We have a strong service contract with Pelambres and are actively working with SQM.

What distinguishes Chile from the rest of the world?

Chile has been a pioneer in the electric market, and due to accessibility to renewable resources, the cost of energy is low in comparison to other jurisdictions. With the right initiatives, Chile has the potential to transform itself into a world reference in the production of lithium.

In society, mining is a highly questioned industry for the impact it has on the natural world. However, Chile is fundamentally a mining country. The economy is supported and maintained by the activities of the sector. Unlike jurisdictions like Peru, where social problems can get in the way of mining activities, Chile has a regulatory framework that allows for control.

Aggreko is looking to expand into the lithium market in Catamarca, Salta, and Jujuy. Can you discuss these plans?

In 2022 we decided to open a yard in Salta to go along with the growth in northwest Argentina with lithium. From this strategic location we serve our businesses in the three provinces. Today we can say that it was a good decision. We currently have more than 30 MW of generation and we operate with all mining companies that are in different stages of development of their projects.

What technologies is Aggreko investing in to help clients reach sustainability goals?

We want to change the technology of air compressors so that diesel is replaced by electric compressors. This will lead to no emissions. Nearly all the large mining companies in Chile are committed to reducing emissions by 30% by 2030. We aim to facilitate the adoption of new, cleaner technologies to assist them in achieving this objective.

What is the process of changing energy sources from diesel to renewable?

The process is not difficult. Large mining companies have such large energy demands. They mainly acquire this energy through large Power Purchase Agreements (PPA). However, the backup plants of their critical processes can easily and quickly be changed to renewable energy sources. This is our expertise, and we can assist clients with this change. We see a great opportunity for this. We are in discussions for a project to implement a 4 or 5 MW capacity system. The project involves BESS (Battery Energy Storage Systems) technology, which helps to manage variability and ensure a steady supply of electricity.

What factors are impeding the growth of the Chilean mining sector?

On average, in Chile it takes 10 years to approve a project, which discourages investors from coming to the country. In Peru, on the other hand, you can get a project running in 2.5 years, but social issues can affect the development of new projects.

Chile lacks big projects to propel itself forward. Looking at big mining projects, Quebrada Blanca underwent expansion, which has ended, Pelambres made a small expansion and Codelco has abstained from making investments. This led to a stall in the market. The problem is not that companies do not want to invest. The interest is there. The state is not approving the projects. If the world wants batteries, we need copper and lithium, but, most importantly, we need speed.

What is Aggreko's competitive advantage and how will this be used to reach the company's goals?

We are flexible and agile, and we offer energy solutions that are efficient, reliable and sustainable. We have the economic power to support what we do. We are quick and do not leave our clients without energy. We are the biggest company in the world with this type of solution. We have 10 gigawatts of installed capacity.

Our goal is economic growth, which will be based on medium and long-term contracts. Long-term contracts will also allow clients to reach their sustainability goals more easily. In 2025, we hope 20% of our revenue will come from alternative solutions. Our goal is also to reach 25% female inclusion by 2025. ■



Mauricio Mazuela

General Manager
HITACHI ENERGY

How would Hitachi Energy (Hitachi) characterize 2023?

2023 was a tremendously good year for Hitachi in Chile. Our growth projection and goals were exceeded. We had an explosion of new technologies, all aimed at making processes more efficient and promoting our sustainable electrification model. In 2024, we moved offices. We are also greatly focusing on sustainability.

One of my dreams for the company was actualized this year. We installed a remote monitoring center in our office. This will enable us to provide a 24/7 monitoring service. With augmented reality, we can work as if we were in the field. We used remote monitoring solutions at Escondida, BHP, Cerro Gorda, and Pelambres, among others. This milestone means there will be fewer people in the field and poses a minimized risk of inadequate performance. We are looking into predictive models to see when maintenance can be advanced or postponed, optimizing the resources of our clients.

Can you detail Hitachi's recent work at Quebrada Blanca II?

All the electrification in Teck's desalination and concentrator plants was our responsibility, which included high-voltage systems, transformers, control, automation, and monitoring solutions. ■



Sergio del Campo

President
SONNEDIX CHILE

What were Sonnedix's growth milestones in 2023?

Our recent acquisition of Enel Chile's photovoltaic solar portfolio shows our growing presence in the electrical market. Currently, we are the third largest renewable energy company in Chile in utility size renewable capacity, thanks to this acquisition and others made in 2022.

We have commenced operations at our Meseta de los Andes photovoltaic solar plant, which is the largest in the Valparaíso region and significantly contributes to the country's energy supply, especially in the metropolitan region. With contracts with the electric Distribution utilities and a capacity of 160 megawatts, this project strengthens our portfolio and ensures a competitive and reliable supply for Chilean households.

How is the Chilean government facilitating the goal of achieving 100% renewable energy by 2050?

Chile has experienced a surge in renewable energy projects, with over 90% of recent developments focusing on wind, solar and storage. This trend positions the country for a future of competitive energy prices and international market competitiveness, backed by renewable energy. Additionally, efforts to reduce dependency on fuel imports enhance long-term economic stability, mitigating vulnerability to global commodity price fluctuations. ■



María Teresa González

Country Manager
STATKRAFT CHILE

What is Statkraft's footprint in Chile?

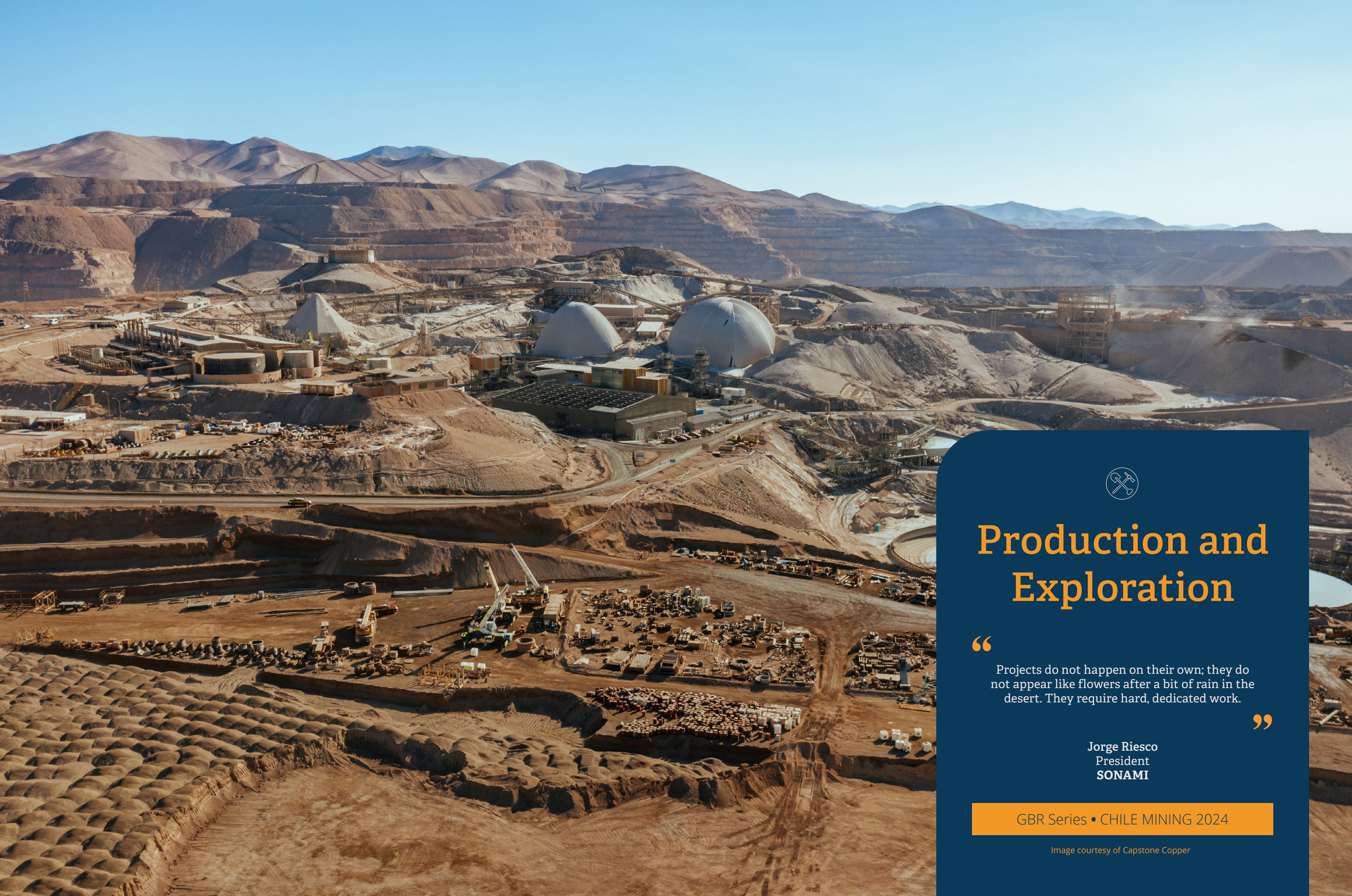
Since 2020, Statkraft Chile has been actively expanding. We acquired three wind farms that will start operations in 2024. We own three hydroelectric plants, two more in a joint venture with Pacific Hydro, and three wind farms in the O'Higgins region. In northern Chile, we have a large solar portfolio and a hybrid solar, wind, and battery project called Winds of the Desert. We also have solar projects in central Chile. Our portfolio boasts 2 GW of capacity in various stages of development.

What is the relationship between renewable energy and mining companies?

Chile is one of the countries that is most exposed to the effects of climate change because of its geography. Mining, the main driver of Chile's economy, recognizes these effects and collaborates with renewable energy companies for emission-free energy. In Chile, renewable energy and mining are the perfect marriage.

What role does the state play in Chile's march toward neutrality?

The current timelines for obtaining permits make it impossible to complete all the necessary projects to replace coal. Current permit lead times can kill a project. ■



Production and Exploration

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Projects do not happen on their own; they do not appear like flowers after a bit of rain in the desert. They require hard, dedicated work.

”

Jorge Riesco
President
SONAMI

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Image courtesy of Capstone Copper



Copper Production and Development

Mind the gap between the decarbonization train and the supply

On May 21st, copper prices surged to the highest-ever level on the London Metal Exchange, breaching US\$11,000/t for the first time on a rally that began in April. Although copper demand continues to increase due to electrification and the green energy transition, recent price shifts are a supply driven story. Following the declaration that First Quantum's Cobre Panama's mining concession

was unconstitutional, the mine was ordered to shut down in November 2023. Cobre Panama accounted for 1.5% of global copper production. In addition to the closure of Cobre Panama, production levels in Chile hit a 25-year low, and dropped 2.3%, slumping to 5.33 million metric tons per year (t/y). Production across Anglo American's operations fell 13.3% and Codelco's by 8.2%. Ramp up at

Quebrada Blanca was slower than anticipated, and copper production across Teck's operations totaled 296,500 t/y, down from the 320,000-365,000 t/y range set in production guidance. "Copper supply is subject to the world's increasingly complicated dynamics. Within a year, the copper deficit increased by 1 million t of refined copper," said Mario Molina, country manager and vice president of sales, LATAM at CRU.

Despite predictions of a major surplus, according to the International Copper Study Group, the disruptions in Panama and lower-than-predicted production rates in Chile flipped the market to a major deficit. "This cascades down into the copper concentrates treatment and refining charges (TC/RC) market. Smelters do not believe they will have the necessary supply of concentrate, leading to a drop in TC/RCs. The fee has fallen rapidly on the spot market as smelters compete for supply", said Aurora Davidson, CEO of Amerigo Resources.

In December, China's Copper Smelter Purchase Team (CSPT) set a buying guidance of US\$80/t or 0.8/lb, equivalent to the agreed upon price between Chinese smelters and miners Antofagasta and Freeport-McMoRan. This level was already down 16% from CSPT's guidance for Q4 2023. At the beginning of Q2 2024, TC/RCs hit record lows; the copper market has reached unprecedented tightness. For Chile, this signifies both risk and opportunity. "Chile has seen a reduction in copper output at a time when the market's appetite for it is expanding. This scenario underscores a criti-

cal issue but also highlights an opportunity. By reinvigorating production, Chile can capitalize on the copper market's growth," emphasized Juan Ignacio Guzmán, CEO of GEM Mining Consulting.

Chile: a gap filler

To fill the potential supply gap of 7.7 million t/y by 2034, mining companies will require prices of US\$10,000/t, and possibly as high as US\$12,000/t, according to Jeremy Weir, CEO of Trafigura, who presented at the World Copper Conference. Chile will play a significant role in meeting this gap said Molina: "Of the 7.7 million t gap, 50% would come from South America, with Central America, especially Panama, also playing a role. Chile is the leader, followed by Peru. Panama remains uncertain due to its recent governmental changes. Chile has the highest number of projects, with 70 in total, covering 51% of the missing tonnage."

Chile has the potential to be a 'gap filler', defined by Santiago Montt, CEO of Los Andes Copper: "Chile is the country with the potential and ambition to have a significant role in closing the gap that the energy transition will create between copper supply and demand."

Chile holds the world's largest share of known copper reserves, at 21.3%, according to the United States Geological Survey (USGS) and is home to the world's three largest copper producers. The long-standing number one producer, Codelco, is forecast to be taken down under by Australian miner BHP, according to Bloomberg Intelligence estimates for 2024. BHP's production is predicted to reach 1.44 million t, surpassing Codelco's predicted 1.41 million t. The two are followed by Freeport-McMoRan's 1.34 million t estimate. Codelco has an opportunity for recovery, as its structural projects are projected to boost copper production to 1.7 million t/y by 2030, according to the miner's 3Q23 report.

State-owned Codelco operates eight mines across Chile, responsible for 25-30% of the country's production. The company has four structural projects—at Chuquicamata, Rajo Inca, Andina and El Teniente— in its pipeline, requiring investments exceeding

US\$40 billion. "Chuquicamata Underground reached 56.2% progress; in the portfolio of projects at El Teniente, Andes Norte advanced to 81.8%, Diamante to 39.1%, and Andesita reached 42.5%; while Rajo Inca showed a total progress of 76.1% and Traspaso Andina completed its construction on April 2," said Rubén Alvarado Vigar, Codelco's CEO.

Chuquicamata Underground's project, with a CapEx of US\$6.2 billion, includes infrastructure for access, ventilation, conveyor systems, crusher, and areas for production start. The company submitted their environmental assessment in February 2024 and anticipate the mine to reach capacity by 2030. Rajo Inca's project extends Salvador's mine life by 47 years through the opening of an open-pit mine and performing an overhaul and marginal expansion of the concentrator plant. Operations are set to begin in H1 2024. At Andina, expansion of the pit created the need to relocate the crushing infrastructure, which was built over 50 years ago. The proj-

ect will allow access to high-grade minerals and pit exploitation for another 40 years. Expansion of El Teniente's LOM at Andes Norte, Diamante and Andesita, require investments of US\$1.93 billion, US\$730 million, and US\$513 million respectively. Production plunged 32% in April 2024 from a year ago, attributed to the effects of a rock collapse.

Production at BHP's operations across Chile reached 894,000 t in H2 2023, a 7% increase from the same period in 2022. According to the company's March 2024 operational review, production at Escondida, Chile largest copper mine, is expected to rise 7%, with a production guidance between 1,08 and 1,18 million t for FY24. Spence production increased by 3% to a nine-month record of 189,000 t, driven by improved concentrator throughput and higher recoveries. FY 2024 production guidance is anticipated between 210,000 and 250,000 t/y. Cerro Colorado was placed on temporary care and maintenance in

>> 27



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Marimaca is rapidly moving the Marimaca Project towards production alongside exploring its significant regional land position for new copper discoveries. This project showcases substantial exploration potential and a low risk profile. It is expected to become one of the newest greenfield copper developments in Chile.

In 2023, Marimaca welcomed Mitsubishi Corporation as a cornerstone shareholder, with the investment representing a strong endorsement of the quality of both the Company and the Marimaca Copper Project from an exceptionally well-respected and established stakeholder.

The Definitive Feasibility Study is currently underway at the Marimaca Copper Project, with the study expected to demonstrate a unique, high-quality development project with low execution risk.

Marimaca completed its third Digbee ESG Assessment in 2023, achieving an 'A' score, reflecting its ongoing commitment to sustainable and responsible operations.

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The next stage of our growth story has begun. In Q1 2024, we started the construction of the Centinela Second Concentrator Project, which will add a further 170,000 t/y of copper-equivalent production.

”

Iván Arriagada

CEO
ANTOFAGASTA MINERALS

What were operational highlights from Antofagasta Minerals in 2023 and beginning of 2024?

2023 was another strong year for Antofagasta. We marked our 43rd year of operating copper mines and made critical decisions to further develop our two major mining districts: Los Pelambres and Centinela. The significant investments we've announced give us a solid foundation for profitable growth to provide the copper needed to enable the energy transition.

The numbers tell a positive story. We delivered strong operational and financial performance in 2023, including a 5% increase in EBITDA and an 11% increase in cash flow from operations, underpinned by higher copper production following the construction of the first expansion phase at Los Pelambres. Our Q1 production and cost performance at our mine sites was in line with our expectations, and we expect Antofagasta's production profile to increase quarter-on-quarter throughout the remainder of the year.

The next stage of our growth story has begun. In the first quarter of 2024, we started the full construction of the Centinela Second Concentrator Project, which will add a further 170,000 t/y of copper-equivalent production. First copper is scheduled for 2027.

In March, Antofagasta Minerals inaugurated a US\$2 billion desalination plant at Los Pelambres. What benefits will the plant bring?

Water scarcity is a significant challenge for the mining industry, particularly in Chile. This project underscores our proactive approach towards addressing the issue. We are moving ahead with our plan to double the desalination plant's capacity and construct a new concentrate pipeline, following a route that runs along a less populated area. This will help secure the future of Los Pelambres by providing the water from non-continental sources. Importantly, this will help us advance toward our goal of 90% of water use coming from seawater or recirculated sources, while also providing operational stability.

Antofagasta Minerals released its Climate Action Plan in March 2024. What is the vision and what sustainability measures is the firm employing?

The plan reflects our goal to build on the progress we have made and to meet the new and ambitious medium-

term targets that we have set: to reduce our Scope 1 and 2 emissions by 50% by 2035, with 2020 as baseline, and to cut Scope 3 emissions by 10% by 2030, using 2022 as a baseline for projecting emissions. As one of the world's leading copper producers, we are committed to supplying this critical mineral in a responsible and sustainable way.

We were one of the first mining companies in Chile to make a complete transition to renewable energy supply contracts in all our operations, and we plan to keep going. Replacing and reducing diesel consumption in our trucks by piloting a trolley-assist method using electricity, using autonomous trucks which are more efficient, and introducing automation at our mines are keys to the strategy.

How is Antofagasta Minerals planning to take advantage of high copper prices?

The price of copper is only part of our story, as we can't control prices. What we can control is the way we mine that copper. Keeping our costs down, engaging with communities to ensure a harmonious and mutually beneficial relationship, focussing on our environmental responsibilities regarding water, emissions, and biodiversity, and on being the best operators, partners and employers, are all vital for a sustainable business regardless of where we are in the pricing cycle. Having said that, macro trends such as the need for critical minerals like copper to enable the energy transition are expected to support copper prices over the longer term.

What are Antofagasta Mineral's objectives for the rest of 2024?

In the short term, we look at the rest of the year with optimism. We believe we are in a strong position to provide an increasing supply of copper, and we are confident that the strategic investments we've made in recent months and years will pave the way for the next phase of growth. That includes continuing the development of the future of Los Pelambres following the completion of the first stage of expansion, building out the Second Concentrator at Centinela, and capitalizing on our investment in Buenaventura in Peru, which we expect to add further development options over time. At the same time, our exploration program in Chile is progressing well as we aim to further grow our resource base. ■



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We are working so that, starting in 2024, production begins its long-term growth trajectory, progressively increasing until reaching the level of 1.7 million t/y by 2030.

”

Rubén Alvarado Vigar

CEO
CODELCO

What milestones did Codelco achieve in 2023 and early 2024?

In May 2023, the Ventanas smelter furnaces were shut down, a historic event for the Corporation, carried out with full social peace and in dialogue with our workers. Also in May, we began construction of the plant that will provide desalinated water to the Chuquicamata, Radomiro Tomic, and Ministro Hales. In November, we signed a joint venture with the mining giant Rio Tinto to explore and develop a copper project in the Atacama Region; and in December we achieved The Copper Mark certification for our mines, smelters, and refineries, which confirms that we are applying the highest sustainability standards.

Regarding the progress of the structural projects, as of March 31 of this year, the first phase of the Level 1 infrastructure of Chuquicamata Underground reached 56.2% progress; in the portfolio of projects at El Teniente, Andes Norte advanced to 81.8%, Diamante to 39.1%, and Andesita reached 42.5%; while Rajo Inca showed a total progress of 76.1% and Traspaso Andina completed its construction on April 2, with the delivery of secondary crushing to the operation.

On the other hand, I cannot fail to mention our incursion into the lithium business with an agreement with SQM for the development of lithium in the Salar de Atacama starting in 2025; this is added to the work we carried out in the Salar de Maricunga, where we completed exploration work on our properties and the purchase of Lithium Power International (LPI), which was completed in March of this year- allowing us to make a significant lithium project viable in that salar.

How will collaboration improve Codelco's future and ensure growth?

Our portfolio of organic growth through structural projects is complemented by opportunities derived from strategic collaborations with third parties. Through these alliances we have obtained invaluable information and consolidated our presence in top-tier assets, forging partnerships with leading companies in the industry.

Among them, our commitment with El Abra and Anglo American Sur stands out, with the latter being the owner of Los Bronces. Additionally, our recent agreement with Rio Tinto for the exploration and development of Nuevo Cobre in the Atacama region exemplifies our proactive stance to-

wards growth. We anticipate that future growth will also be driven by existing and emerging collaborations.

How is Codelco deploying technology to improve efficiency and reduce operational costs?

We have many examples of technology already integrated into automation, robotics, and advanced analytics: we have more than 300 pieces of equipment managed from various Integrated Operations Centers located kilometers away. For example, 280 rock breakers, LHDs, hoppers, and semi-autonomous or teleoperated trains for the underground mines of Chuquicamata, Andina, and El Teniente; in addition to 20 trucks and two fully autonomous drills for the open-pit mines of Gabriela Mistral and Radomiro Tomic.

For the long term, our focus is on disruptive innovation. For example, we are working on chlorinated leaching of sulfides, which will allow us to use the installed capacity for the treatment of oxides. We are also working with the Japanese company Komatsu on a cutting-edge tunneling machine that will remove workers from risky operations, does not require the use of explosives, and allows for resource development in a sustainable manner. We are involved in the joint development with Nippon Yusen Kabushiki Kaisha and Enaex of an industrial pilot for a green corridor to transport copper concentrates from Chile, using a new technology of ships powered by green ammonia, among other projects.

While in 1990 we allocated US\$ 8 million to innovation and technology, in the last 10 years, that budget grew by 750%, and today our average annual expenditure is US\$60 million.

What are Codelco's strategies to achieve increased in copper production through 2030?

Our perspective is that 2024's annual production will be slightly above 2023. We have reinforced our plans for intensive monitoring of operations and critical efforts to meet our production targets. Among them are increased operational continuity at the Andina concentrator, ensuring better performance at the Chuquicamata underground mine, the commissioning of the Rajo Inca project, and improved open-pit mine management at Ministro Hales. We are working so that, starting in 2024, production begins its long-term growth trajectory, progressively increasing until reaching the level of 1.7 million t/y by 2030. ■



“ Last April, Spence achieved 100% of autonomy of its mining trucks fleet leading to improved safety and mining productivity. ”

Brandon Craig

President
BHP AMERICAS

What are BHP's growth plans in Chile?

In Chile, our copper assets, Pampa Norte and Escondida, represent 26% of the total copper production in the country, and we have projects in evaluation and execution phase in both operations. We have been in Chile for over 30 years, and we expect to continue growing for the next decades in the country.

Can you discuss Escondida's and Pampa Norte's performance in 2023?

Last year, Escondida produced 1.073 million t, which is 4,4% more than the previous year, while Pampa Norte reported 279,6000 t of copper production.

Today we are focused on our current operations, on how we maintain operational excellence and grow organically through optimization and expansion processes.

During the last fiscal year our economic contribution to the country reached US\$8.8 billion, with over 25,000 employees and contractors working in the company and US\$1 billion spent across companies based in Antofagasta and Tarapacá.

How does the implementation of technology allow BHP's assets to be more efficient?

The role of technology is fundamental to safely sustain the growth and efficiency of our operations. Concrete examples of the positive impacts on operational efficiency resulting from the incorporation of technology is our autonomy program. Last April, Spence achieved 100% of autonomy of its mining trucks fleet leading to improved safety and mining productivity. Also, the use of Artificial Intelligence and Machine Learning has allowed us to capture efficiencies in water and energy consumption, and to improve the flotation process in our concentrator plants.

How does BHP view recent changes in Chile's mining royalty laws and tax framework?

The royalty discussion was very complex. We always all had one thing in common: it was essential to maintain Chile as a competitive player in the global copper industry. Today, with the law in force, we can see how royalties are reaching the regions and supporting the social agenda of the communities where we operate.

Given the good dialogue that was established during the royalty debate, we can now work towards new improvements in other areas, such as permits. From our perspec-

tive, a reform to the permitting system requires rationalization and a systemic view with a focus on delivering real outcomes, and not just to the process itself. Speeding up the permitting process will allow the country to find solutions to unlock large investments and to optimize current operations, capturing all the positive consequences in revenues, job creation and social value to the country.

Spence set a benchmark in the Chilean mining industry for its representation of women in the workforce. What is the impact of this accomplishment on operational performance and workplace culture?

Our aspiration to achieve gender balance goes far beyond Spence. In 2016, we made a global commitment to achieve gender balance by 2025. At the time, the company only had 17.5% female representation and no player in the industry had committed to a goal of this magnitude.

We started on a path that we now know was right. We designed policies to close possible wage gaps, to adapt our recruitment and retention processes, to change the infrastructure of our sites, strengthen labor flexibility plans and designed training programs. In addition, we have found that incorporating more women significantly increases team productivity, improves safety, and creates more inclusive environments.

Chile and the Americas were BHP's first region to achieve gender balance. In Chile alone, we are almost three times the industry average, and at Spence we have the highest representation of women at any mine in Chile – exceeding 42%.

Now we are turning our attention to how we can advance diversity and inclusion as we go forward. Just as an example, how we create conditions to include people from the LGBT+ community, people with disabilities, members of Indigenous communities and other minorities. Achieving gender balance is only the first step.

What are BHP's plans to maintain its position as one of Chile's top copper producers?

As a company, we have the capacity to face an ever-changing industry: we have an amazing workforce and an operating system that has enabled us to adapt to headwinds and uncertainties. It is through this that we will continue to invest in the long term safety, productivity and growth of our business. Certainly, at BHP we want to remain one of the leaders in the industry. ■



“ We are always seeking near-term production increases through better efficiencies and productivity, but making a significant impact by 2027 will be tough for us and the industry. ”

Joshua Olmsted

President and COO Americas
FREEPORT-MCMORAN

Can you provide recent operational highlights from El Abra?

In 2023 and early 2024, we focused on ramping up production to pre-pandemic levels. The team did an excellent job achieving full capacity. Copper production has been driven by the grade and material type from the mine, with lower volumes compared to pre-pandemic due to lower grade ore. We also have seen positive progress in community involvement and engagement, marking significant achievements over the past year and into 2024.

Can you discuss the potential and plans for the recent modelled and drilled sulfide resource?

We have known about a significant sulfide resource for a long time and have invested heavily in defining it over the past decade. This resource, located below and adjacent to our current mining area, offers exciting opportunities for leveraging our existing operation, facilities, and workforce. We have conducted extensive work, including engineering and mine planning. The resource has the potential to add 500-600 million lb/y of copper if developed as a milling project.

How will El Abra help Freeport-McMoRan address the copper shortage?

The market offers a great opportunity for copper producers, but the challenge is meeting the impending demand gap. For El Abra, completing engineering, permitting, and constructing a project the size of the potential sulfide resource by 2027 – when demand is predicted to outpace production – is not feasible. This highlights the industry's challenge to execute projects quickly. Improving Chile's permitting process is essential. We are always seeking near-term production increases through better efficiencies and productivity, but making a significant impact by 2027 will be tough for us and the industry.

How does Freeport plan to take advantage of copper's recent highs?

While the price is high, input costs like power, diesel, and labor have also risen. Additionally, grades are decreasing over time so our team is dedicated to maximizing production, minimizing costs, and leveraging the high copper price. Specifically, for El Abra, this is an opportunity to generate cash to fund a portion of the sulfide project as well as ongoing sustaining capital required for operations, so optimizing processes is crucial.

How is Freeport using technology to boost productivity?

We are using data analytics in mining, optimizing truck fleets with remote monitoring and proactive maintenance, and leveraging data to improve recoveries, like with our leaching initiatives. These tools help us recover copper previously considered unrecoverable. We are also implementing autonomous haulage at our Bagdad operation in the US to evaluate its benefits, aiding in our transition to an all-electric haulage fleet. By leveraging data, we can make better decisions and respond in real-time.

Can you discuss El Abra's water source transition and environmental impact mitigation initiatives?

Historically, we have used water from the Salar de Atacama, but we are transitioning to other sources. This year, we are working on engineering and feasibility studies to submit an EIS for extending the operation's life, building another leach pad, and constructing a desalination plant on the coast. This will allow us to stop using water from the Salar de Atacama. In 2023, we sourced all our energy from renewables, aiming for long-term renewable energy use. We are also collaborating with Caterpillar and Komatsu to develop all-electric trucks to reduce GHG emissions from our haulage fleet. This transition will take time, but we are committed to understanding and implementing these technologies.

Can you discuss Freeport-McMoRan's community engagement efforts at El Abra?

Through initiatives like the agricultural fund partnership and the Coastal Edge Sustainable Development Program, we have fostered strong relationships with local communities. These efforts, particularly with indigenous agricultural communities near El Abra, aim to support their livelihoods and long-term visions. By closely collaborating with these communities, understanding their needs, and providing support, we have been able to sustain our operations while facilitating their development.

What are the key priorities for El Abra?

We are committed to maximizing production, minimizing costs, and generating cash to support the development of growth projects. We are advancing feasibility work to bolster these growth endeavors, with plans to potentially submit an Environmental Impact Assessment by the end of this year or next. This initiative will lay the groundwork for future projects while sustaining our ongoing operations. ■



“

We expect progressively stronger copper production from Quebrada Blanca in each quarter throughout the rest of the year as we ramp up to full capacity by year-end.

”

Jonathan Price

President and CEO
TECK RESOURCES

Can you discuss operational highlights from 2023 and Q1 2024 for Quebrada Blanca and Carmen de Andacollo?

2023 was a pivotal year for Teck's copper growth strategy as we ramped up production at our newly expanded Quebrada Blanca (QB) operation, highlighted by record quarterly copper production in Q4 2023. That ramp up has continued in 2024, and we have now completed all major construction at QB, including the port and the molybdenum plant. The ramp up of QB is already being reflected on our operational results for 2024, with total Teck copper production in the first quarter of 99,000 t, which was 74% higher than the same period last year.

We expect progressively stronger copper production from QB in each quarter throughout the rest of the year as we ramp up to full capacity by year-end.

Carmen de Andacollo produced 6,900 t of copper in Q1 2024 and continues to be an important part of our overall copper portfolio.

What does the sale of the steelmaking coal business mean for Teck and the importance of Chile in your business plans moving forward?

The sale of the steelmaking coal business will mark a major shift at Teck as we focus entirely on providing the metals that matter for global development and the energy transition. The proceeds of the sale will help to ensure we are well-capitalized to execute on our growth strategy, and to position Teck as a leader in responsibly supplying essential metals, particularly copper.

What is Teck's approach to sustainability?

At Teck, sustainability is woven into everything we do. That approach is demonstrated in our QB expansion project, as from the start, we considered environmental and social performance as essential to its success. We started building local relationships years before permitting and construction, and today we have 22 agreements in place with Indigenous communities and fishermen's unions to share in the benefits of QB, including a focus on local employment and diversity, with about 27% of the operation's employees being women.

We built the region's first full-scale desalination plant for QB, and secured 100% renewable power for the operation to minimize emissions. Those measures were essential in

helping build the support necessary to move forward, establishing trust with our stakeholders, and advancing to completion.

How is Teck adapting its strategies in Chile to navigate evolving global markets and geopolitical challenges and what is the role of responsible mining within this?

We cannot meet global climate goals without a significant increase in mining critical minerals – particularly copper, which is key to electrification. Our task as an industry is twofold: we have to produce more metals than ever, with less impact than ever. Estimates suggest global copper demand will likely double by 2050, from 25 million to 50 million t/y. We have to meet that demand while also meeting increasing environmental and social expectations.

Finding a way forward to both grow the supply of essential metals like copper while reducing our footprint is the most important challenge facing our industry. Teck has prioritized sustainability performance for decades, not just because it's the right thing to do, but also because it's directly connected to business success.

How does Teck view the future of the copper industry in Chile?

Chile is a great place to do business, with skilled and experienced people, and a strong, modern mining sector, and is an important focus for Teck's future growth.

Chile's copper industry can and will play a significant role in helping supply the world with the single most critical mineral for decarbonization and the energy transition. Chile's mining industry cannot fill that demand alone, but it is already leading the way, showing how to build new projects with the highest environmental and social standards.

What are Teck's strategic goals for 2024-2025?

Our first priority is completing the ramp up of our newly expanded QB operation and achieving full production. Beyond QB, we are focused on continuing to grow our copper portfolio, with a number of copper projects in various stages of development, including potential future expansion of QB. QB's initial mine life of 27 years will use less than a fifth of the available resource, so there's significant potential for further growth. ■

>> 21

December 2023. "In Chile," Brandon Craig, president of BHP Americas emphasized: "Our copper assets —Pampa Norte and Escondida— represent 26% of the total copper production in the country, and we have projects in evaluation and execution phase in both operations."

At the El Abra operations in Chile, Freeport-McMoRan has drilled out and modeled a large sulfide resource and is planning for potential submission of an environmental impact statement by year-end 2025. "This resource, located below and adjacent to our current mining area, offers exciting opportunities for leveraging our existing operation, facilities, and workforce. We have conducted extensive work, including engineering and mine planning. The resource has the potential to add 500-600 million lb/y of copper if developed as a milling project," said Joshua Olmsted, president and COO Americas at Freeport-McMoRan.

At Antofagasta Minerals: "The next stage of our growth story has begun," said Iván Arriagada the CEO. "In the first quarter of 2024, we started the full construction of the Centinela Second Concentrator project, which will add a further 170,000 t/y of copper-equivalent production. First copper is scheduled for 2027," Arriagada continued.

Teck Resources sold its entire interest in its steelmaking coal business in Q4 2023. "Teck will focus entirely on providing the metals that matter for global development and the energy transition," said Johnathan Price, the firm's president and CEO. "The proceeds of the sale will help to ensure we are well-capitalized to execute on our growth strategy," he continued.

That growth strategy has gone well. Teck's Quebrada Blanca (QB) achieved record quarterly copper production during Q4 2023, producing 34,300 t. In December 2023, Quebrada operated at near throughput capacity. "That ramp up has continued in 2024, and we have now completed all major construction at QB, including the port and the molybdenum plant. The ramp up of QB is already being reflected on our operational results for 2024, with total Teck copper production in the first quarter of 99,000 t, which was 74% higher than the same period last year," highlighted Price.

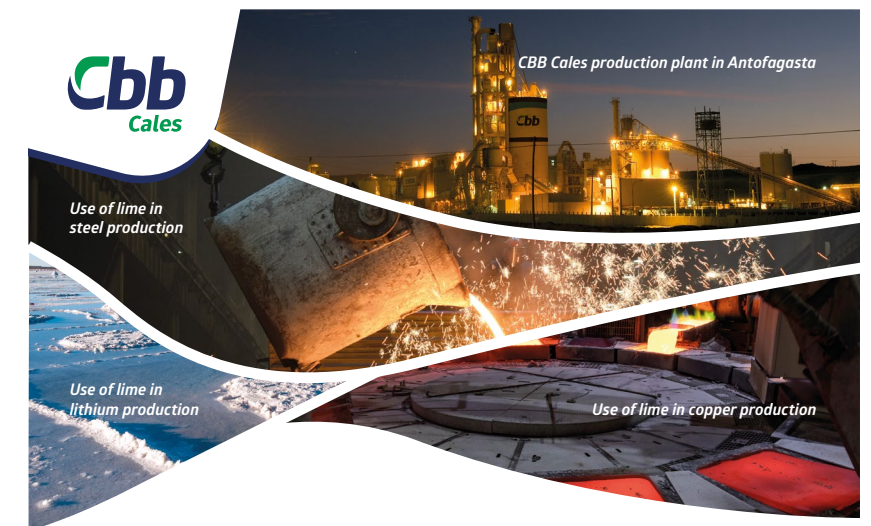
The Collahuasi joint venture between Glencore, Anglo American and JX Nippon Mining & Metals produced 573,000 t of fine copper in 2023. "We received approval from the authorities for the expansion project, which will extend the site's life by 20 years, an initiative that also includes a desalination plant," said Andrés Souper, general manager at Glencore Chile.

On track or off the rails?

The next few years will be a crucial turning point for the industry as demand for copper is forecast to grow 20% by 2035, according to analysis by S&P Global. If Chile cannot meet demand, the world will turn elsewhere. Investment in the mining sector in Peru has grown to US\$54.56 billion for 2024, up 2.7% from 2023. "Regulators need to support jurisdictions in their quest for competitiveness, thus attracting more investments and technological advancements. Otherwise, mining companies may seek opportunities elsewhere," said Augusto Cauti, consultant and strategic advisor at Turner & Townsend.

However, jurisdictions following Chile in terms of reserves, like Peru and the Democratic Republic of Congo, lack the expertise and established, large-scale industry that Chile benefits from. "Chile's high added value lies in its mining culture and legal stability. Despite discussions on royalty percentages, the country consistently supports mining projects. This strong mining culture and stability attract investors, helping to close the gap and advance projects," emphasized Molina.

Chile's mining sector is at a crossroads. The global energy transition is well underway, but production has yet to see a significant increase. With reform, investment, and a push for sustainability, the industry has a chance to revitalize production and fill the global copper supply gap. The outlook is positive with Cochilco predicting production to reach 5.51 million t/y in 2024, a 5% increase from 2023. Yet, time is of the essence. As the decarbonization train leaves the station, Chile must act swiftly to remain in the driver's seat. ■



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2023 was a very good year for Glencore's operations in Chile. It was a year of great milestones, considering some of the events that took place at our sites.

”

Andrés Souper

General Manager
GLENCORE CHILE

How would you assess Glencore Chile's performance in 2023?

2023 was a very good year for Glencore's operations in Chile. It could be said that it was a year of great milestones, considering some of the events that took place at our sites.

The Altonorte Metallurgical Complex, our smelter, celebrated thirty years of producing and marketing copper anodes, sulfuric acid, and copper in solution (PLS). In 2023, 254,798 t/y of copper anodes were produced; 867,785 t/y of sulfuric acid and 963,070 t/y of new charge were processed.

Regarding Lomas Bayas Mining Company, extracting low-grade copper in Chile, it also had good production figures, recording 65,800 t/y of cathodes. The operation launched its first autonomous extraction trucks and the first autonomous drill. All of the above is part of the Lomas Lab project, a joint initiative between the mining company and Glencore's Operational Excellence and Technology area, which seeks to position the site as a technology laboratory of the group.

And regarding our Collahuasi JV, it was also a good year. In 2023, they received approval from the authorities for their expansion project, which will extend the site's life by 20 years, an initiative that also includes a desalination plant. In 2023 Collahuasi produced 573,000 t of fine copper.

Can you describe recent environmental initiatives?

We recently achieved a new and important milestone in Altonorte, thanks to a contract that will provide us with a cleaner, safer, and lower-cost fuel for the next three years. This action is part of a strategy defined by Glencore, aiming to reduce emissions by 50% by 2035 and by 100% by 2050.

Among the most relevant benefits that will be achieved using natural gas are the reduction of greenhouse gas emissions and the reduction of particulate matter emissions associated with fuel handling.

Distribution will be carried out through the Atacama Gas Pipeline, which operates from Argentina to Chile. This eliminates trucks.

This type of energy is fully aligned with strategies and project development to make our smelter more efficient in terms of safety, environment, and operational cost. Among the operational benefits, natural gas, being more environmentally friendly, allows for better process control, equipment care, and, most importantly, is safer, as its density makes it lighter than air, preventing the formation of explosive mixtures by concentration.

How should the mining industry address the global copper shortage and what role will producers in Chile play?

The global copper shortage poses significant challenges for the mining industry. Chilean producers, as one of the main copper exporters worldwide, will play a crucial role in addressing this situation.

On one hand, there is a need to intensify exploration efforts to discover new reserves, which requires investing in advanced technologies and more efficient exploration methods. The adoption of automated systems, artificial intelligence, and sustainable technologies in the extraction and processing of copper can improve efficiency and reduce costs.

However, these measures are not effective unless complemented by other elements that will ensure the sustainability of the business in the future. These elements include, for example, diversifying energy sources, efficient water management, compliance with strict environmental and social standards, developing local capabilities, and collaboration and strategic alliances to exchange knowledge, technologies, and resources specific to the mining industry, both nationally and internationally.

What are Glencore Chile's strategic goals for 2024?

The first and most important thing is to continue producing copper in the efficient, safe, and innovative way, fulfilling our purpose: to responsibly provide the products that make everyday life possible.

In this sense, maintaining production goals is crucial for the interests of the group not only at the country level but also globally. As expected, Chile, along with Peru and Argentina, are key players in providing this mineral for Glencore.

Other important objectives include the implementation of the Copper Management System (CMS) to promote safe, reliable, and responsible operations; the consolidation of our Safework safety program, which establishes procedures and standards to prevent accidents and save lives; strengthening our organizational culture and leadership, which will align us as a company and promote transparency and responsibility; and attracting, retaining, and developing talent, framed within respect for human rights, cultural diversity, age inclusion, and gender. ■



“

Our neighbouring Santo Domingo project can unlock district scale synergies and provides another growth lever for Capstone and for copper production from the Atacama region in Chile.

”

John MacKenzie

CEO
CAPSTONE COPPER

What were operational highlights from Mantos Blancos and Mantoverde during 2023 and the beginnings of 2024?

Mantos Blancos is an operating, open-pit copper-silver mine located in the north of Chile in the Antofagasta province and sits ~900 m above sea level. Mantos Blancos has been in operation since 1960 and we recently completed a major growth initiative to process higher grade sulphides. We produced almost 50,000 t of copper in 2023, and we have guided for 53,000 t in 2024 as we ramp-up our sulphide and unlock the full capabilities of our 20,000 t/d plant.

Mantoverde is an operating, open-pit copper-gold mine in the Atacama region of Chile, 45 km from the coast and ~880 m above sea level. The mine is currently transitioning from its historic oxide mining (which began in 1995) to sulphide copper mining, which is known as the Mantoverde Development Project (MVDP). In 2023, we largely completed construction of the US\$870 million MVDP, and we are now in the commissioning and ramp-up phase. In 2023 we produced 35,000 t of copper at Mantoverde, and we have guided for copper production in 2024 of around 68,000 t. At full rates, we expect Mantoverde to produce close to 120,000 t/y copper, before factoring in our next growth phase.

What is the importance of Capstone Copper's Chilean operations receiving the Copper Mark?

We are thrilled that both Mantoverde and Mantos Blancos were awarded the Copper Mark in September 2023. The Copper Mark is a powerful advocate for transparency and accountability and reinforces our values on responsible production. We take pride in the achievements of our Chilean operations, and we are actively striving to replicate this success across our portfolio in the Americas.

In March 2023, we announced our new Sustainable Development Strategy and the adoption of GHG emissions reduction targets to support our commitment to responsible copper production.

Can you discuss MVDP Optimized and the Mantoverde-Santo Domingo District Integration Plan?

While we remain focused on the execution of our current phase of growth, we are also very excited about the potential that exists at Mantoverde and in the district with significant synergies at Santo Domingo. At Mantoverde, sulphide reserves in the mine plan represent only ~20%

of overall resources, indicating the opportunity for both mine life extension and expansion. We are advancing studies to increase the throughput capacity.

Our neighbouring Santo Domingo project can unlock district scale synergies and provides another growth lever for Capstone and for copper production from the Atacama region in Chile. We are working on an updated feasibility study for Santo Domingo that contemplates processing over 70,000 t/d of ore and producing over 100,000 t/y of copper.

We are also evaluating a district cobalt counter-current ion exchange plant for Mantoverde – Santo Domingo that may unlock cobalt production from the region. We are currently operating a small-scale pilot plant at Mantoverde, with the potential to become one of the largest and lowest cost battery grade cobalt producers in the world.

How is Capstone Copper deepening its understanding of climate-related risks?

In November, we published our first combined Sustainability Report for Capstone Copper, "Growing Responsibly." This Report provides enhanced information on our global sustainability policies and more in-depth information on community engagement practices and biodiversity management. We also reported emissions intensity data per unit of ore processed and unit of copper produced to give a clear and transparent picture of our emissions. In 2024, we plan to continue this trend of enhanced reporting by disclosing the results of our climate-related risks and opportunities assessment and scenario analysis which started in 2023. This work will further inform our business strategy and climate decarbonization plan.

As part of our Sustainable Development Strategy, we set a target to reduce greenhouse gas emissions from fuel and power by 30% by 2030, compared to 2021 baseline levels. To achieve this, we are adding more renewable power to our energy mix, studying independent renewable energy generation alternatives, and displacing diesel consumption.

Responsible operating practices are a vital component of our commitment to the environment, our employees, local communities and governments, and must remain front of mind in everything we do. We recognize our role to be a responsible producer of copper given its critical role in supporting decarbonization and electrification efforts globally. ■



Aurora Davidson

CEO
AMERIGO RESOURCES

What is Amerigo Resources' sustainable business model?

Our model is simple: generate additional economic value from recovering copper from waste material. We are working with the end product of another company's process and extracting value.

How do you assess the supply and demand fundamentals of copper?

Miners that have been producing copper for decades are facing lower ore grades, water restrictions, deeper operations, and higher environmental compliance costs. In our industry, we cannot just turn on a switch to put more mined supply into the market. It will take decades to reach step-ups in copper supply. Concurrently with this scenario where concentrate supply is stressed, there is an emerging new stream of demand for copper from electrification and decarbonization. The copper concentrate market is so constrained that any disruption in supply causes a significant flip in the market. In October 2023, analysts said there would be a surplus in 2024. The disruptions in Panama and news from major producers declaring lower ex-

pected production output turned the market from a projected surplus to a projected deficit. This cascades down into the TCRC market. Smelters do not believe they will have the necessary supply of concentrate, leading to a drop in TCRCs. TCRCs have fallen rapidly on the spot market as smelters compete for supply.

How is Amerigo Resources strategizing its financial operations?

We have a simple, streamlined, and transparent business model. We must work safely, produce copper, and do it economically. In the last few years, we have reduced our debt substantially. We undertook US\$100 million worth of debt to finance the Cauquenes expansion. By year-end 2024, we will be down to US\$11.5 million in debt. After our regular investments and debt reduction, surplus operating cash is being distributed to shareholders.

What are Amerigo's goals?

Our goal is to keep on top of the regulatory framework, look at worldwide best practices, and ensure we operate daily as efficiently and safely as possible. ■

What is the strategic significance of the Punitaqui mine acquisition?

The acquisition of the Punitaqui mine in May 2021 marked a pivotal moment for us. Following its closure due to falling copper prices, we negotiated a deal with the mine's creditors to secure its assets. Our subsequent exploration program significantly increased the mine's resources from less than 250,000 t to 6.2 million t in indicated resources and 3.1 million t in inferred resources. This expansion has instilled confidence in restarting operations, advancing us toward cash flow generation and operational growth.

How is the timeline progressing to bring Punitaqui online?

In March 2024, we secured the necessary capital for restarting operations. In December 2023, we began preoperational activities at the mine, including repairs, upgrades, permitting efforts, engineering studies, and mine development. As of April, the mill is 95% complete, and significant progress has been made in the mine development. Community support, including local hiring initiatives, has been instrumental. The focus is on production ramp-up for the remainder of 2024, with next

year targeting full production capacity. This marks a significant milestone for Chile as a new mine initiating copper production operations.

What ESG considerations were considered in operations?

Community engagement has been our priority from the start. Understanding and addressing community perspectives, especially considering the mine shutdown's historical context, has been crucial. We have consistently built trust and managed expectations, resulting in positive relationships with local communities. Moving forward, community engagement remains a primary focus.

On the environmental front, we are making significant progress by transitioning to a filtered tailings system. This shift reduces our environmental footprint and reduces water usage to less than half.

What are Battery Mineral Resources' goals for the next two years?

Our successful drill program has shown the longevity of our resources and our ability to expand them. Although we paused drilling temporarily for financial planning, we are eager to resume exploration. ■



Martin Kostuik

CEO
BATTERY MINERAL
RESOURCES



Copper Exploration

Reforms and collaborations set the course for the industry's future

With an exploration budget of US\$832 million, Chile ranks fourth globally, trailing only behind the US, Canada and Australia. There are 226 exploration projects in Chile, and 53.1% of them are copper-focused, according to the Chilean Copper Commission (Cochilco). Addressing the copper shortage will require bringing new projects online.

The burden of exploration has been placed on junior players, like Filo Corporation*, said Jamie Beck, Filo's CEO: "Major mining companies have reduced their exploration spend, leaving room for juniors to fill this void."

A geological jackpot

Fortunately, before Chile was a country, it was a mining territory. Chile's copper deposits are primarily due to its position along the Pacific Ring of Fire, where the Nazca Plate subducts beneath the South American Plate. This subduction produced significant volcanic and magmatic activity, leading to the formation of large-scale porphyry copper systems and iron oxide copper gold (IOCG) deposits. Globally, only four major IOCG belts exist: the Central Andean IOCG belt in Chile, the Olympic Dam region in South Australia, the Carajás Mineral Province in Brazil, and the Bergslagen district in Sweden. "These deposits offer highly mineralized, steeply dipping deep rooted vein structures with mineable widths, providing favorable conditions for mining operations," explained Alastair McIntyre, CEO and president of Altiplano Metals.

The Andes' rapid uplift exposed deep-seated deposits near the surface, which makes mining operations more technically feasible and economically efficient compared to other countries. "In Australia companies will explore for IOCG deposits below up to 1,000 m of cover," said Paul Gow, CEO of Tribeca Resources. "For projects like Tribeca's La Higuera in the Coquimbo region of Northern Chile, the cover is typically much shallower, around 50-80 m of gravel," he continued.

Some projects marry different aspects of Chile unique geology. "Filo Del Sol features a unique oxide cap atop the deposit, which presents a distinct style of mineralization," started Beck. "However, subsequent drilling revealed a larger sulphide deposit beneath the oxides. This exploration success has positioned Filo Del Sol as one of the world's largest undeveloped copper projects," he continued.

Despite the geology, exploration is not happening quickly enough. Shawn Wallace, CEO and chairman at Torq Resources emphasized: "The key metric to monitor is whether we are finding enough to replace what we are mining, and currently, that balance seems precarious."

New permitting to permit optimism

Global lead times from discovery to production continue to breach all-time highs. According to S&P Global, for the 127 new mines that began operations worldwide from 2002 to 2023, the average time from discovery to commercial production was 15.7 years. For copper mining, exploration averages two to eight years, according to the University of Arizona.

However, Chile is making strides at addressing this delay. After the royalty bill was passed, a working group produced two documents: "A baseline analysis identifying the permits with the longest processing times and the areas with delays in project permit acquisition, and a roadmap developed by the

Defining a Copper-Gold Giant in Chile



ATEX Resources (TSXV: ATX) hosts the Valeriano copper-gold project in Chile, located 125km east of Vallenar city, within the Link Belt, in north-central Chile. ATEX is focused on delineating and growing the copper-gold porphyry resource underlying a surface oxide gold deposit. ATEX recently concluded the Phase IV drill program returning the highest grades to date and remaining open in all directions.

Valeriano hosts a large copper gold porphyry resource: 1.41 billion tonnes at 0.67% CuEq (0.50% Cu, 0.20 g/t Au, 0.96 g/t Ag and 63.80 g/t Mo), which includes a higher-grade core totaling 200 million tonnes at 0.84% CuEq (0.62% Cu, 0.29 g/t Au 1.25 g/t Ag and 55.7 g/t Mo), reported in September 2023.

The Phase V drill program is expected to start in H2 2024 and could continue to grow the deposit significantly and provide the foundation for an eventual PEA.



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Ministry of Finance to address these inefficiencies and bottlenecks," explained Joaquín Villarino, executive president at Consejo Minero.

At the inauguration ceremony for Quebrada Blanca II, President Gabriel Boric committed to reducing lead times by 30%. This action will not only benefit the sector, but also the state. "If the approval period is reduced by a third, for every US\$1 billion that is invested, the state collects US\$240 million," said Villarino.

Many juniors view Boric's approach to mining favorably. "President Boric's statements at the CESCO dinner underscore his support for the mining industry and its importance to Chile's economic well-being. While some permitting processes have faced delays, particularly in initial stages, Chile's overall permitting environment remains robust. Numerous projects, including large-scale ones, have obtained permits or environmental approvals in under 12 months," said Hayden Locke, president and CEO of Marimaca Copper.

Reforms ignite exploration

Starting January 1st, 2024, amendments to Law No. 21,420, refined by Law No. 21,649, came into effect, introducing

the first modifications to Chile's mining regulatory framework since 1983. These changes alter the concession system, aiming to enhance mining activity and decrease concession hoarding. Of the current 90,000 concessions that cover 16 million ha of Chile, 40% are held by 10 companies. Of these concessions, only 10% are active. Wallace explained the implications: "Larger companies can secure extensive land holdings and maintain them with minimal activity, which may hinder opportunities for greenfield exploration. Implementing stricter regulations on mineral tenure could stimulate the exploration landscape by compelling companies to actively explore or relinquish their claims."

Law 21,420 increases patent fees for exploration concessions from 1/50 to 3/50 Monthly Tax Units (UTM) per hectare for both metallic and non-metallic mining fees. For exploitation concessions, the mining fees will increase progressively from 4/10 UTM per hectare for the first five years, up to 12 UTM per hectare from the 31st year onwards. "By raising fees, the government aims to deter companies from holding onto licenses without substantial progress or investment. This measure encour-

ages companies to either commit more earnestly to exploration efforts or relinquish licenses, thereby creating opportunities for other groups to engage in exploration and mining activities," explained Antony Harwood, CEO and president at Montero Mining.

Law 21,420 also increases exploration concessions from two years to four years. However, once the concession term has expired, the concession will be extinguished, unless an extension is requested and supported by a report of the geological information obtained from exploration work or proof of an Environmental Qualification Resolution or ongoing Environmental Impact Assessment to the National Geology and Mining Service.

We are all in this together

Collaboration has surfaced in the copper exploration sector to overcome some of the industry's challenges. One such collaborative move is taking place in Chile's Huasco valley. Hot Chili created a large-scale, multi-user desalinated water network serving the entire Huasco Valley. José Ignacio Silva, executive vice president at the firm, elaborated: "Hot Chili is launching a new water company to tackle water scarcity in the Atacama region. Leveraging an eight-year water concession, we will supply desalinated water to mining firms and communities, aiming to foster collaboration, lessen environmental impact, and cut costs."

Other players in the Huasco Valley, like ATEX Resources, believe actions such as these will position the district at the top of the global scale. "Hot Chili's desalination project reduces capital requirements for NuevaUnion (Teck-Newmont), El Encierro (Barrick-AMSA), and ATEX by at least US\$1 billion. With 10 more years of exploration, this area has the potential to become one of the largest copper producing districts in the world. Fast-tracking of new discoveries due to enhanced infrastructure will be a game changer for copper supply in Chile, with significant international benefits," said Ben Pullinger, CEO of the company.

"Synergies with other developing deposits in the region are vital, as significant infrastructure will be needed. Along with Vicuña, El Encierro, Fortuna and Costa del Fuego, we have the chance to develop a major mining hub in north-central Chile," Craig Nelsen, chairman at ATEX Resources, chimed in.

Chile's extensive exploration efforts and regulatory reforms signal a commitment to addressing the copper supply challenge and maintaining its leadership in the global copper market. ■



“ Our location in the coastal Atacama region offers an arid climate and sparse vegetation. With the nearest town over 20 km away, our project minimally impacts local landowners and existing land use. ”

Hayden Locke

President and CEO
MARIMACA COPPER

What are highlights from drill and metallurgical programs at the Marimaca Oxide Deposit?

In May 2024, we increased the measured and inferred resource 44% to reach 200 million t at 0.45% CuT. 86% of our resources now fall within the measured and indicated category, improving our confidence as we progress towards definitive feasibility. Regarding metallurgical work, our focus was on identifying areas for optimization, primarily targeting acid consumption. We anticipate reductions in acid consumption while maintaining recovery levels.

What is the timeline for the DFS?

We expect to have the results of the DFS available early in the new year. We are actively preparing our permit and environmental approval applications, having recently conducted our first voluntary public consultation. We aim to submit our final application to authorities in July or August.

Can you comment on the regulatory environment in Chile?

President Boric's statements at the CESCO dinner underscore his support for the mining industry. While some permitting processes have faced delays, particularly in initial stages, Chile's overall permitting environment remains robust. Numerous projects, including large-scale ones, have obtained permits or environmental approvals in under 12 months. Although more complex projects may encounter longer timelines, Chile offers transpar-

ency, well-regulated processes, and effective communication with the government, making it a favorable environment for mining.

How does your location contribute to the ease of environmental permitting?

Our location in the coastal Atacama region offers an arid climate and sparse vegetation. With the nearest town over 20 km away, our project minimally impacts local landowners and existing land use.

We will utilize recycled seawater and renewable energy sources through power purchase agreements. We are dedicated to responsible land use and comprehensive rehabilitation post-mining to restore the area to its natural state.

What benefits does heap leach processing provide Marimaca Oxide Deposit?

Heap leach processing, though rare in global copper supply due to limited oxide or leachable copper deposits, provides several benefits. It reduces water usage, utilizing approximately 10% of the water that traditional flotation plants use. It is also more efficient in material movement, resulting in lower total carbon intensity. Unlike sulfide flotation projects, which require additional emissions from concentrate processing, we directly ship copper cathode as the final product. Wood Mackenzie estimates a 30-40% higher carbon intensity for concentrate projects compared to cathode projects.

Can you discuss the geological upside of the project?

Marimaca Copper now controls a land package of 25 kilometers. In 2021, we identified three new targets and made three shallow oxide discoveries. Our team aims to unlock further value, particularly in satellite oxide deposits and the Sierra de Medina project, offering significant resource expansion opportunities.

How does Marimaca plan to capitalize on copper's bullish trend?

Even amidst high inflation and interest rates, demand remains strong, especially from countries investing in electrified infrastructure. This demand, coupled with a slow supply response in the copper industry, sets the stage for significant price increases. Marimaca is strategically positioned to benefit from this trend with its relatively low capital costs and accelerated timeline, aiming to start production within three to four years.

Can you describe Marimaca's 2024 regional exploration strategy?

We recognized a significant amount of historical data across our property, reducing exploration risk. A significant influence of this strategy, particularly at Sierra de Medina is the Cachorro discovery, made by AMSA, with approximately 300 million t of ore at over 1% CuT. We are analyzing historical data and conducting geophysical work to pinpoint follow-up drilling targets. We aim to commence drilling on these targets in the latter half of 2024.

What are the company's plans?

We plan to submit our permit application in mid-2024 and would expect to receive environmental approval within 12 months, all going smoothly. Following that, we will secure additional permits, which should take about six months. Ideally, we aim for our final investment decision (FID) by year-end 2025, coinciding with the commencement of construction. We will finalize the DFS by the year's end and initiate discussions with debt financing partners. We are exploring strategic financing options for the period leading up to FID. Once FID is secured, we will seek partners for project construction. Over the next 18 months, these steps will pave the way for the early stages of construction of Chile's newest copper mine by 2026. ■

ASX: HCH | TSXV: HCH | OTCQX: HHLKF



A new copper supplier is coming

Hot Chili is well positioned to capitalize on the impending copper supply deficit – an inevitable outcome of the push to electrify everything and a depleted project pipeline globally.

The Company controls large-scale assets in two of the most critical commodities of our time – copper and water – with two of the most desirable attributes – low-risk and near-term.

Given the region's limited groundwater resources, the close proximity of the Las Losas Port and permission to use raw seawater for processing (maritime concession and land access granted) means all water required for the operations are already secured and also provide the Project with additional strong environmental credentials.

Costa Fuego is the only advanced senior copper development in the America's located at low-altitude (less than 1,000m elevation), 50km from an existing port.



www.hotchili.net.au
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Jamie Beck

President and CEO
FILO CORP.

Can you introduce Filo Corp. (Filo)?

Filo is focused on advancing our 100% owned Filo Del Sol project, situated on the border between Chile and Argentina. The company is currently exploring for copper, gold, and silver in the Andes. We have strong support from our major shareholders, the Lundin family and BHP.

Our recent successes at Filo Del Sol have been remarkable. We have encountered multiple kilometer-long intersections of over 1% copper equivalent across a 5 km north-south strike length. We are planning to conduct over 40,000 m of drilling in 2024, with nine diamond drill rigs in operation.

What differentiates Filo Del Sol's geology?

Filo Del Sol features a unique oxide cap atop the deposit, which presents a distinct style of mineralization. Initially, our geological efforts centered on this oxide zone, culminating in a pre-feasibility study in January 2019. However, subsequent drilling revealed a larger sulphide deposit beneath the oxides. This exploration success has positioned Filo Del Sol as one of the world's largest undeveloped copper

projects. The presence of both oxide and sulphide mineralization opens up opportunities for phased development, offering flexibility in our approach to resource extraction and processing.

When does Filo anticipate transitioning into production?

Determining the right time for production is pivotal. Currently, our focus remains on adding value through exploration. Filo Del Sol's unique attributes allow for a phased development approach, starting with a smaller operation and potentially expanding over time. Our pre-feasibility studies suggest a feasible initial investment of US\$1.8 billion, offering flexibility for future expansion. As we continue to advance our understanding of the deposit and de-risk the project, we will assess the optimal timing for transitioning into production.

Major mining companies have reduced their exploration spend, leaving room for juniors to fill this void. As the demand for copper continues to grow, projects like Filo Del Sol will play a significant role in meeting the world's evolving needs. ■

Can you provide updates on Santa Cecilia?

In 2023, we prioritized initiating our first drill program at Santa Cecilia after first securing a seven-year community agreement. To prepare for drilling, we conducted a comprehensive early-stage exploration program, which included mapping, geochemistry, sampling, re-logging historical core and anything else we could do to optimize drilling efforts amidst challenging capital markets. Our drilling began with targeting the Cerro del Medio area, where there were two historical drill holes, one of which intercepted almost 1 km of copper and gold. We drilled two additional holes and successfully increased the gold grade, which leads us to believe we are vectoring closer toward the high-grade causative intrusion.

Our exploration efforts also identified new, previously untested porphyry targets on the property that demonstrate copper on surface. They are located within 1-2 km of the Caspiche deposit, which is part of Newmont & Barrick's Norte Abierto project. This was the focus for our latest drilling campaign, on the eastern region of the

project at the Pircas Norte and Gemelos Norte targets, and we are awaiting results.

Our positioning offers operational synergies that could catalyze regional developments, addressing issues like water scarcity through investments in desalination infrastructure. Major shareholders like Gold Fields, which owns just over 15% of Torq, also enhances our project's credibility.

Can you outline Margarita's potential?

Initially targeted as an iron oxide, copper and gold deposit (IOGC), we were surprised by the unusually high gold grades we encountered in our Falla 13 discovery (90 m of 0.94% copper and 0.84 g/t gold). We have since delineated significant gold grades over 800 m and discovered a parallel structure, which requires further drilling. We also encountered oxide copper in the southern portion of the property. Oxide copper, particularly with good grades and thickness, offers cost-effective mining. Margarita's advantageous location at a lower altitude, close to mining infrastructure and paved roads, adds to its appeal. ■



Shawn Wallace

CEO
TORQ RESOURCES



José Ignacio Silva

Executive Vice President
HOT CHILI LIMITED

“ Hot Chili is focused on moving towards construction as fast as possible as copper price is the biggest sensitivity issue of the project. ”

What are key updates from Hot Chili in 2023?

In 2023, the most significant update for Hot Chili was the PEA of the Costa Fuego project, issued in late June. The latest resource revealed an indicated resource of 798 million t grading 0.45% CuEq and an Inferred Resource of 203 million t grading 0.31%, totaling 3.4 million t of copper content (2.9 million t indicated and 0.5 million t inferred). The project boasts 3 million oz of gold (2.6 million oz indicated and 0.4 million oz inferred), 68 million lb of molybdenum (56 million lb indicated and 12 million lb inferred), and 15.8 million oz of silver (12.9 million oz indicated and 2.9 million oz inferred).

With more than 85% of its mineral content being copper, Costa Fuego is well-positioned for the looming structural shortage in copper supply. The project features a low start-up capital with a fast payback period, 16 years of mine life (both open-pit and underground), and an average annual production of 95,000 t of fine copper (112,000 t of CuEq). 97% of the latest inventory is indicated, showing a high confidence level in the resource. For every US\$0.1 cents increase in the copper price above US\$3.85/lb, the post-tax NPV increases by US\$100 million.

What makes the Costa Fuego project unique?

This well-defined, low-risk ore body is located at a low elevation of less than 1,000 meters in the coastal range. Unlike high-altitude projects, Costa Fuego requires lower CapEx and faces fewer logistical challenges. Its proximity to infrastructure (about

55 km from the port, right on the side of the Pan American Highway), just 600 kilometers north of Santiago, enhances feasibility of construction.

What are the benefits of the MOU with Las Losas Port for Hot Chili?

The MOU with Las Losas Port allows Hot Chili to negotiate a binding port service agreement. We will fund 20% of the cost over two years to develop a feasibility study for a bulk tonnage copper concentrate facility. Las Losas Port currently lacks such a facility. This collaboration aims to minimize OpEx for loading bulk copper. The agreement also involves selecting engineering companies to advance the project, ensuring that Costa Fuego will use Las Losas Port for exporting concentrates.

How does Hot Chili plan to leverage the recent copper price highs?

Hot Chili aims to capitalize on this favorable market by advancing the Costa Fuego project quickly. The PEA was based on a copper price of \$3.85/lb, but with current prices around \$4.75/lb, the project's financial outlook is significantly improved. Hot Chili is focused on moving towards construction as fast as possible as copper price is the biggest sensitivity issue of the project. This strategy is supported by recent successful fundraising efforts, ensuring sufficient cash reserves to advance studies and avoid delays typically caused by funding constraints.

Can you elaborate on the new water company and its collaboration goals?

Hot Chili is launching a new water

company to tackle water scarcity in the Atacama region. Leveraging a process that took eight-years to get the water concession, we will supply desalinated water to industrial firms and communities in the El Huasco valley, aiming to foster collaboration, lessen environmental impact, and cut costs. Initially serving the Costa Fuego project, we are in talks with several potential off-takers.

Why is the Domeyko project acquisition significant for Hot Chili?

This acquisition aligns with Hot Chili's strategy of thorough regional exploration in the Atacama region. This project offers significant exploration potential, and Hot Chili plans to evaluate it quickly through early exploration and drilling. If the results are promising, we will advance it; otherwise, we will drop the options. This approach aims to continually increase the metal resources and exploration footprint, enhancing the overall project portfolio and ensures a steady pipeline of projects to meet growing copper demand.

What are Hot Chili's drilling plans and key objectives for the next couple of years?

Hot Chili is currently engaged in a 10,000-meter drilling campaign, focusing on technical geotechnical drilling, metallurgical drilling, and hydro drilling to support the PFS and environmental studies. While exploration drilling continues, the primary focus is on advancing the Costa Fuego project. The company aims to complete the PFS by year-end 2024 and to submit an EIA in the first semester next year. ■



Santiago Montt

CEO
LOS ANDES COPPER

Can you discuss key milestones achieved by Los Andes Copper in 2023?

In 2023, we completed our NI 43-101 PFS. We reported 1.22 billion t of proven & probable reserves at 0.36% copper, 136 ppm molybdenum, 1.1 g/t silver, and 917 million t of probable reserves at 0.34% copper, 136 ppm molybdenum, 1.1 g/t silver. Our project has a US\$2.8 billion post-tax net present value (@8%), an internal rate of return of 24% at US\$3.68/lb copper, US\$12.9/lb molybdenum and US\$21.79/oz silver, with a pre-production capital cost of US\$2.4 billion and a construction period of 3.25 years.

We foresee completing the PFS optimization in 2024 and moving towards feasibility studies by year end 2025. This sets us up for environmental assessment around 2026, initiating construction by 2028. We aim to commence operations by 2030.

What is the benefit of Vizcachitas's location in the Central Copper Belt?

Vizcachitas is in the Miocene metallogenic belt in central Chile, surrounded by some of the most relevant deposits in the world like Pelambres, Andina, Los Bronces and El Teniente. The region has substantial infrastructure available to mining projects, lowering initial CapEx, facilitating efficient operations and contributing significantly to copper production not only within Chile but globally. ■



Alastair McIntyre

CEO and President
ALTIPLANO METALS

Can you provide updates from El Peñón mill and how it differentiates Altiplano?

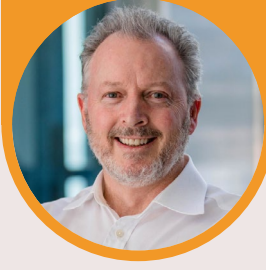
Our dual focus on exploration and production/processing, a rarity among mining companies. While many companies in this sector follow a pattern of exploration, fundraising, and repeating the process grow the business, our aim is sustainability. We intend to generate revenue consistently for general operations without relying solely on external funding. We recognize the importance of providing investors with growth opportunities. Our next objective is to acquire a significant exploration project that offers substantial upside potential, such as district-scale exploration or discovery prospects.

Can you provide an update on Altiplano's exploration targets?

We prioritize agility in exploration, capitalizing on Chile's new streamlined permitting process for asset acquisition. Our focus centers on regional consolidation, such as extending operations at the Farellon underground mine. We have taken significant steps by securing an option for the Santa Beatrice project, strategically located near Farellon and exhibiting promising geological similarities, including multiple vein structures.

What are Altiplano's priorities for the next two years?

Altiplano's focus lies on optimizing its recently completed processing facility and exploring strategic acquisition opportunities to drive growth. ■



Paul Gow

CEO
TRIBECA RESOURCES

Could you introduce your La Higuera project?

We have taken initial drill results from various targets showing copper systems and continued exploration under the associated gravel cover nearby. Utilizing geophysical data like ground magnetic, IP, and gravity data, we are showing that outcropping mineralization extends to covered areas.

What differentiates Chile, and especially its costal IOCG belt?

The coastal belt, hosting IOCG deposits, presents relatively unexplored opportunities compared to other regions. Accessing sites in Chile is notably easier, especially compared to challenging terrain like Brazil's often with dense vegetation. Furthermore, recent regulatory changes in Chile have enhanced exploration prospects, with further improvements anticipated.

Existing infrastructure in the coastal belt enables quicker project development at lower costs. Compared to higher altitude locations, the coastal belt's infrastructure makes it more favorable for junior exploration companies.

How have the regulatory changes in Chile impacted exploration efforts?

One notable change is the adoption of the "use it or lose it" philosophy, which requires permit holders to actively explore their designated areas or risk losing their permits. This promotes the turnover of licenses and benefits those actively engaged in exploration. ■

Ben Pullinger and Craig Nelsen

BP: President and CEO
CN: Chairman
ATEX RESOURCES



BP



CN

What were the standout results from ATEX's 2023/24 drilling campaigns?

BP: Everything from ATEX's Phase IV drill program has been a highlight. The initial holes revealed a major continuity trend to the northwest. Hole 16A returned 1.48% CuEq (1.53% CuEq with metallurgical results) over 112 meters. An unexpected porphyry was found in the gap between the central and eastern trends, indicating potential continuity. Hole 25, starting at -87 degrees and flattening to 48 degrees, showed continuous mineralization from 1,500 m, confirming the strike. Hole 17B revealed continuous and sporadic mineralization, suggesting potential similarity to Hole 16A. Hole 26 linked the high-grade trend seen in previous phases, confirming 1% CuEq mineralization in the last 100 m.

We identified a high-grade core approximately 600 m along strike and 300 m wide, open to the north. Each hole has contributed to our understanding, suggesting a larger project for the upcoming Phase V drill program.

CN: The speed of payback on a large capital investment will be crucial. Synergies with other developing deposits in the region are vital, as significant infrastructure will be needed. Along with Vicuña, El Encierro, Fortuna and Costa del Fuego, we have the chance to develop a major mining hub in north-central Chile.

Can you provide highlights from the September 2023 Mineral Resource Estimate?

BP: The September 2023 resource estimate included 1.4 billion t of inferred copper mineralization at a 0.4% cutoff. At a break-even cutoff of closer to 0.3%, Valeriano hosts almost 2.5 billion t. We chose to report the resource at a higher cutoff as we feel that this gives a fairer reflection of a potential economic cutoff for the project with an average grade of 0.67% CuEq calculated using our resource model metallurgical recovery assumptions (90% for copper, 70% for gold). When applying our actual metallurgical recoveries, released in October 2023 (95% for copper, 94% for gold), the grade increases to 0.7% CuEq.

We think this bodes very well for the project as we move through de-risking the project and start to look towards a PEA at the end of 2025.

What differentiates Valeriano's geology?

BP: We have granodioritic intrusions into a flat-lying Permian rhyolite volcanic sequence with high silica and

low iron, resulting in chalcopyrite-dominated mineralization with bornite. The equigranular chalcopyrite is visually fine-grained but medium grade metallurgically, extending in all directions. We simply grind the rock and float it to achieve high recoveries. Initially, we thought there was more wall rock involvement, but it is now clear that granodiorite intrusions dominate and mineralize the surrounding wall rock. A significant surprise was the late-stage epithermal system overprinting the porphyry, giving us 2% grades. It is clean, with no arsenic or selenium, allowing production using existing processing techniques.

A block cave operation of this scale offers significant benefits. Once the payback period is complete, it becomes a fixed-cost operation for the remainder of the mine's life. Unlike open-pit mines, there is minimal additional capital intensity after initial investments.

What is your vision of the district?

BP: If we consider current trends, such as shortened permitting timelines and national infrastructure investments, the future looks promising. For example, Hot Chili's desalinization project reduces capital requirements for NuevaUnion (Teck-Newmont), El Encierro (Barrick-AMSA), and ATEX by at least US\$1 billion. Between Codelco's exploration in the area, La Fortuna, and El Encierro, there are already multiple discoveries, not considering Vicuña to the north. With 10 more years of exploration, this area has the potential to become one of the largest copper producing districts in the world. Fast-tracking of new discoveries due to enhanced infrastructure will be a game changer for copper supply in Chile, with significant international benefits.

What is ATEX's approach to community relations?

CN: Our community relations team in Chile has built strong relationships in the Huasco Valley. Open, honest communication with our neighbors is crucial for developing this district.

BP: PreparATEX is a special initiative where we find working-age individuals in Huasco interested in joining our industry and offer opportunities to work on our project. This benefits us by eliminating misunderstandings. This initiative is about providing opportunities and fostering long-term relationships. It ensures that people see who we are, what we are doing, and how we operate, promoting transparency and eliminating misconceptions. ■



Gold Production and Exploration

Copper's Chilean little brother is growing up

Chile is the world's 21st largest producer of gold, accounting for 1.2% of global production. Production is up 20% in the country since 2021. Gold prices reached a historic high of US\$2483.68/oz in July 2024. Global conflicts in the Middle East and Ukraine, concerns over a weakening dollar, inflation, and the potential for interest rate cuts feed into the price highs. Gold holdings in central banks increased 62% year-on-year, and investments in global exchange-traded

gold funds doubled, according to the US Geological Survey. Although copper and lithium receive the press for the world's sustainability targets, gold cannot be overlooked. "The challenge of humanity to develop technology to live more sustainably not only requires metals like copper and lithium, but also gold. The use of gold in technology has become increasingly important," said Patricio Pinto, external affairs director at Kinross Chile.

Production

One of Chile's few greenfield projects came online in 2024, when Gold Fields' Salares Norte poured first gold in March. The mine is projected to produce 350,000 oz/y gold equivalent. The project took 23 years to develop and cost US\$1.2 billion.

Kinross raised its annual global gold production by 10% last year. Production at La Coipa rose 60% from 2022-2023 to 260,138 oz/y. The area also has more to give, according to Pinto: "La Coipa oxide extensions show promising opportunities to extend mine life to the end of the decade."

The firm's portfolio also includes the Lobo-Marte which is slated for construction in 2025. The operation is expected to contribute an estimated 293,750 oz/y to production.

In March 2023, Pan American Silver acquired Yamana Gold's assets in Chile, which included producing mines El Peñon and Minera Florida. From March to December 2023, gold production reached 95,700 oz and 72,400 oz at El Peñon and Minera Florida respectively.

Exploration


Chile's geology is favorable for gold mining owing to its dynamic tectonic and volcanic history, creating a rich tapestry of mineral deposits. Tesoro Gold discovered the country's first Intrusive Related Gold System. Gold Fields increased its stake in the company to 18.9%. "Our short-term goal is to grow the resource base to 2 million oz and eventually 3 million oz, expanding the open-pit and processing plant to produce 100,000 to 150,000 oz/y for over a decade," said Geoff McNamara, the company's co-founder.

2023 and 2024 have seen important developments pointing towards a golden future for Chile. ■

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“

At La Coipa, 100% of our operations are supplied by 100% renewable energy.

”

Patricio Pinto

External Affairs Director
KINROSS CHILE

How was 2023 for Kinross Chile?

Production at Kinross Chile grew 60% year-on-year from 2022-2023. 2023 was the first full year of operation for the processing plant at La Coipa after its restart. We focused on operational continuity, on reducing process variability, and benefitted from the quality of the growth of our Phase 7 deposit, which is the deposit we are currently exploiting. The mineral grades have also been promising. These are all positive signals that allow us to operate on budget and reinvigorate our strategic plan to return to operate in Chile.

What are La Coipa's operational benefits?

La Coipa is operating aligned with the conditions of its pre-feasibility and feasibility studies. It is an opportune time to be operating within the gold space, as the gold price has reached historical levels. La Coipa has low operational costs. We are translating the operational force into positive gains for the company.

La Coipa oxide extensions show promising opportunities to extend mine life to the end of the decade. We hope to extend it further, but this is a realistic target. We conducted three years of engineering studies to improve knowledge of the ore bodies through geology, geometallurgy, and geotechnical studies. In parallel, we are conducting environmental studies.

What is the importance of sustainable mining for Kinross' operations?

At La Coipa, 100% of our operations are supplied by 100% renewable en-

ergy. The carbon footprint at La Coipa is much smaller than operations of the same size and those of the past.

Efficient water management is also key. La Coipa is one of the few operations in Chile that employs filtered tailings, allowing us to recover and recirculate 80% of the water used, which currently amounts to around 46 liters per second.

Mining is an activity that has a lot of interactions with the environment in which it is found. We are sensitive to this reality and take it into consideration before we design a project. Lobo Marte was designed to have a minimal impact on the surrounding environment and communities. Traditionally mining companies develop a project based on economic and technical criteria and then apply environmental protection measures. Kinross reverted this process, first designing with social and environmental commitments and then focusing on the economic and technical work.

What is the plan for Lobo Marte and recent advancements on the project?

The first step is obtaining the necessary permits. This year we have focused on updating baselines studies. We concluded the environmental impact study previously.

How does Kinross approach community relations?

Kinross has three Chilean assets in the Maricunga Gold Belt of Atacama that are shared with indigenous communities. This is significant because we have already developed long-term relationships with these communities through our operations at La Coipa.

We have learned to share the territory. Lobo Marte is a greenfield project, but the community relationships will be a continuation of those developed at La Coipa. Continuous, honest, and open dialogue has helped us navigate the positive economic effects generated by mining activities, as well as the challenges we face. Hence, it is important for the Colla communities to participate in the baseline studies for future environmental instruments, as this demonstrates that our early engagement is happening across all areas. Learning from the past ensures stronger relationships for the future.

What are the dynamics behind the gold's record-breaking prices?

The challenge of humanity to develop technology to live more sustainably not only requires metals like copper and lithium, but also gold. The use of gold in technology has become increasingly important. As a company we are preparing for both the opportunity and uncertainty created by the high gold price by developing new projects. We have mature assets, but also are developing new ones. We are ready to take advantage of gold's high prices, but also for a time when the price naturally retreats.

What are Kinross' strategic objectives for its Chilean operations?

The first is to successfully operate La Coipa which will act as a bridge for the development of our next big project, Lobo Marte. This will enable us to provide maximum benefit for not only our shareholders, but also for community in the Atacama. We want to generate economic benefit in a sustainable way. ■



Amitai Axelrod

COO & Co-founder
VERAI DISCOVERIES

Can you introduce VerAI's operations and how Chile fits into your strategic framework?

VerAI Discoveries is an Artificial Intelligence (AI) based mineral asset generator, aiming to revolutionize the discovery of critical minerals and metals essential for global energy transformation. Our approach involves deploying AI, particularly machine learning (ML), to significantly enhance the likelihood of uncovering concealed mineral deposits. This technology represents a paradigm shift in the industry, enabling us to explore areas previously inaccessible or overlooked by traditional methods.

Chile holds a pivotal position in our strategy, serving as a focal point for our operations in Latin America. With a rich mineral endowment and a conducive regulatory environment, Chile offers immense potential for mineral discovery and development. Our portfolio in Chile comprises a diverse range of projects, including copper, gold, silver, molybdenum, and more. These projects span over 80,000 acres and are strategically located in the Antofagasta region, in proximity to existing deposits as El Peñon, Guanaco and El Salvador.

What is the added value of AI and ML in mineral exploration?

AI and ML enable us to navigate the challenges of discovering concealed deposits in covered areas. With traditional methods, only 1 in 1,000 exploration projects become a mine. VerAI's

“With traditional methods, only 1 in 1,000 exploration projects become a mine. VerAI's platform is 100 times more accurate, 20 times faster, and 20 times cheaper.”

platform is 100 times more accurate, 20 times faster, and 20 times cheaper. AI accelerates the exploration process, making it more sustainable and economically viable by reducing time and de-risking investments. VerAI can shrink the traditional targeting window from three or four years to two months, while significantly cutting costs. Our scalability allows us to generate multiple asset portfolios across various jurisdictions and commodities, ultimately de-risking decisions and facilitating better outcomes for mining financiers.

From an environmental perspective, our discovery process primarily occurs in the data space, significantly reducing our footprint on the environment compared to traditional methods. We avoid the need for extensive drilling and physical access to remote areas, minimizing disturbance to ecosystems and local communities.

Can you provide a detailed description of VerAI's AI/ML Discovery Platform?

Using ML with customized datasets and an exclusive catalog of profiles of known economic ore bodies, we identify, with a high level of probability, the location of new economic mineral deposits. This approach, primarily focused on geophysics data, produces drill-ready targets across multiple jurisdictions and commodities, and specifically in underexplored covered terrain.

What are the current challenges in the junior mining sector?

The junior mining sector faces significant challenges in discovering new deposits, exacerbated by the depletion of easily accessible resources. This difficulty in discovery hampers fundraising efforts and limits scalability. VerAI addresses these challenges by utilizing scalable AI-driven solutions that enhance the probability of discovering concealed mineral deposits, at scale.

How has the mining industry's stance on AI and ML changed in recent years?

We have observed a growing acceptance of AI and ML within the mining industry, driven by the recognition of the challenges in discovering new deposits and the global success of AI and similar technologies in almost any other sector and industry. VerAI is at the forefront of this shift, leveraging AI technology to address the industry's pain points and increase the probability of success in mineral exploration.

Can you discuss VerAI's collaboration with research centers like MIT?

Our partnership with MIT facilitates our collaboration with companies deploying AI in diverse domains, allowing cross-industry learning and application. This exposure to similar ideas and solutions is invaluable, considering our ambition to introduce proven technologies to our specific discovery challenge. Interdisciplinary efforts, exemplified by collaborations with institutions like MIT, foster innovation by bringing insights from other sectors. These collaborations encourage a systemic and systematic approach to problem-solving, which is essential for scalability and replicability.

What are VerAI's expansion goals in South America?

We are already well-positioned in North and South America with projects and mineral assets across various commodities. We aim to expand further, particularly in Latin America, leveraging our experience and strong partnerships. Our primary objective is to extract significant value by scaling our mineral portfolios and forming new strategic alliances and partnerships with exploration companies and financiers to develop these assets. ■



Geoff McNamara

Co-founder
TESORO GOLD &
CULPEO MINERALS

Can you introduce Tesoro Gold?

Tesoro discovered the El Zorro gold project about 800 km north of Santiago. We drilled it privately for a couple of years and discovered the first Intrusive Related Gold System (IRGS) in Chile. We listed the company on the ASX in February 2020, and now have 570 square km of concessions; the largest and most prospective gold project in Chile.

What makes the intrusive system in Chile unique?

Historically, Chile has three geological belts: the Andes with epithermal gold and silver, the Atacama fault zone with IOCG deposits, and the coastal cordillera, where we focus. The El Zorro project is 15 km from the Pan American highway, with grid power 20 km away and a desalination plant 30 km away. This project is the first IRGS discovered in Chile, giving us a first-mover advantage in what we believe is a new gold province. We are targeting 3 million oz, and making further discoveries within our 570 square km concession package.

Can you provide highlights from the phase one scoping study and the mineral resource estimate?

We have an unconstrained resource at Ternera of 1.5 million oz. The scoping study showed we have an economic project with a CapEx of US\$132 million and an all-in sustaining cost of US\$1,068/oz. NPV pretax is approximately US\$240 million. Our short-term goal is to grow the resource base to 2 million oz and eventually 3 million oz, expanding the open-pit and processing plant to produce 100,000 to 150,000 oz/y for over a decade.

The Ternera deposit is open in all directions and at depth. Our deepest hole intersected good mineralization at 500 m. We are currently drilling at Drone Hill, 700 meters west of Ternera. If we can connect Drone Hill with Ternera, it would significantly increase the mineralized footprint, potentially showing a pathway to a 5-to-6-million-oz deposit. ■

Could you provide us with an update on Astra Exploration's progress during 2023?

In 2023, we completed an environmental impact assessment on the Paciencia claim group, which took about 15 months for approval and limited the type of exploration activities we could conduct during that time. Our exploration focused on expanding the extensive epithermal system through trenching, sampling, mapping and conducting desktop studies. These efforts further validate the presence of a large epithermal system, and confirmed the presence of critical precipitation areas for precious metals deposition. Additionally, we identified a promising copper target. With the environmental permit secured, we are ready for a comprehensive drill test program across the mostly unexplored project area.

Why should the precious metals sector in Chile not be overlooked amidst the current focus on green energy transition metals like copper?

The geological endowment in Chile offers significant potential for precious metal deposits, due to limited exploration. This untapped opportunity is rare and often found in remote locations. Our project stands out as a low-cost exploration and development opportunity due to its accessibility, infrastructure, community support, logistical capabilities, and low environmental sensitivities. These factors collectively present an exceptional opportunity that should not be overlooked.

What are your objectives for the next two years?

The advancement of our current portfolio and strategic acquisitions. In the current environment, there are many cases where good drill results generate no increased market value, or even create a liquidity event where the share price falls. So, we will minimize undertaking the most expensive part of exploration (drilling) in a disinterested market when dilution cost is the highest, and focus on acquisition opportunities where the future value is deemed to far outweigh any dilution cost. I am a firm believer that you make your money when you buy, not when you sell, and these markets are providing rare buying opportunities with a very bullish outlook on the horizon. ■



Brian Miller

CEO
ASTRA EXPLORATION

Lithium Production and Development

An overcharged market

After reaching peak prices in 2022, the lithium market faces a considerable oversupply, resulting in a more than 75% price drop over 2023. This price decline reflects an accelerated ramp-up in production capacities, anticipating robust demand growth, which has not materialized as expected.

Global lithium supply is anticipated to increase by 30% by year's end. Electric vehicle (EV) batteries are largely responsible for demand. Although EV adoption grows—EV sales in the USA were up 40% in Q1 2024, according to Cox Automotive—the pace is slower than anticipated. Bloomberg New Energy Finance projected sales of 1.7 million plug-in vehicles in 2023, but only 1.46 million were sold. EV giant Tesla's sales were down 41% in Q2 2024, its first drop since the pandemic, a further indication of lower EV adoption. "EV adoption and infrastructure for grid support for EV adoption need to catch up to demand. The energy transition is intricately linked, resembling a spider web connecting various elements. It goes beyond just supplying lithium for EVs; it encompasses a global initiative to facilitate this shift," noted Amanda Hall, CEO and founder at Summit Nanotech.

EV as pie: sweet deals fueling the future

In May 2023, SQM, the world's second-largest lithium producer, reached a long-term agreement with Ford Motor Company to provide battery-grade lithium carbonate and lithium hydroxide. In July 2023 the firm entered a new long-term purchase agreement with LG Energy Solution to supply over 100,000 t of battery grade lithium carbonate and lithium hydroxide during 2023-2029 period. In June 2024, SQM also entered a long-term supply deal with Hyundai and Kia.

In February 2024, Albemarle, the world's largest lithium producer, entered a long-term supply agreement with BMW to supply battery-grade lithium hydroxide starting in 2025. This partnership also involves joint research initiatives aimed at advancing lithium-ion battery technology. In 2023, the firm and Ford Motor Company entered a five-year supply agreement that starts in 2026 for Albemarle to supply more than 100,000 t of battery-grade lithium hydroxide for approximately 3 million future Ford EV batteries.

Australia is the world's current leading supplier of lithium, producing 86,000 t of lithium in 2023. However, Australia's operations are dominated by hard rock production, causing environmental concerns about their long-term sustainability. Lithium derived from hard rock is three times as carbon intensive as brine operations. With the rise in responsible min-

ing and consumer consciousness, lithium will increasingly need to be sustainably sourced. The lithium triangle—a high-altitude area straddling Chile, Argentina and Bolivia, which holds 56% of the world's lithium reserves — presents itself as the perfect opportunity. "There is enough lithium in Chile alone to satisfy the world's needs, which can be sourced entirely from brine," said Hall.

Chile: the lithium triangle's hypotenuse

Chile is the world's second-greatest producer of lithium, responsible for 44,000 t in 2023. The signing of the Memorandum of Understanding between SQM and Codelco in December 2023 was a landmark event for Chile's lithium industry, enabling SQM to increase production by 30,000 t/y of lithium carbonate equivalent and extend operations for 30 years. Codelco will own a slight majority share at 50+1%, according to the contract. Carlos Díaz, executive vice president of lithium at SQM provided insight: "The Codelco-SQM partnership aspires to a total additional production for the period 2025-2030 of 300,000 t of LCE and 280,000 to 300,000 t/y of LCE between 2031 and 2060, and Chile will receive 85% of the operational margin through various channels from 2031 onwards."

President Gabriel Boric announced Chile's National Lithium Strategy (NLS) in 2023 to enhance private sector involvement across the lithium value chain while maintaining selective state control in public-private partnerships. However, many industry players remain skeptical about the how effective the NLS will be. "The government has given Codelco and Enami exclusive rights to develop significant lithium deposits, potentially causing conflicts with existing concession holders. Codelco purchased a project from Lithium Power International but admits it lacks the capacity to develop all projects alone and has partnered with SQM for its Atacama project," said Jorge Riesco, president of Sonami.

Investors question the ability of state-owned Codelco to pivot to lithium production, given its history as a copper producer. The miner's US\$244 million acquisition of Lithium Power International's Blanco project in the Salar de Maricunga has raised eyebrows. Codelco will also face the challenge of incorporating DLE, as the project's initial plan to operate with evaporation ponds was rejected under the NLS. The firm, however, marches on: "Codelco has already begun the process of searching for a strategic partner in Maricunga ... our board will choose the future partner in the first part of 2025," said Rubén Alvarado Vigar, the CEO.

Direct lithium extraction

The NLS stands out for its commitment to adopting advanced, environmentally friendly technologies like direct lithium extraction (DLE). This approach is well-justified, as DLE technology company Adionics' CEO, Gabriel Toffani, explained: "With evaporation, up to 40% of lithium reserves are lost, whereas with DLE, we can achieve up to 99% extraction efficiency."

DLE technology is relatively new. "Seven years ago, DLE was almost unheard of, with Livent in Argentina operating the only project," said Steve Kesler, executive chairman of CleanTech Lithium, who contrasted the three principal types: "Adsorption involves passing brine through columns of resin, where lithium is adsorbed. After extracting lithium, the brine is reinjected into the aquifer, without altering the brine's original chemistry, unlike ion exchange, which can to a certain extent acidify surrounding soil upon brine reinjection. Solvent extraction, while quick, poses challenges in eliminating organic materials during entrainment from reinjected brine."

"However," said David Dickson CEO of Argentinean developer Lake Resources, "the DLE fissure is overplayed. The focus should be on optimizing technology efficiency rather than the intricacies of the technologies themselves. For the sector to satisfy demand by 2030, it is crucial that all current DLE technologies operate effectively."

The technology is advancing rapidly. In 2023, SQM partnered with Adionics to pilot their technology. "Initial testing lasted 500 hours," explained Toffani, "subsequently, we conducted an additional 1,000 hours of continuous testing at the Atacama pilot to evaluate the conditions necessary for transitioning to an industrial scale."

SQM is committed to a more sustainable future, as Díaz highlighted: "In 2023 alone, investment in research and development of proprietary processes reached US\$40 million. In recent years, we have completed over 70 conceptual and laboratory studies with varying levels of progress and depth, according to the potential success of different brine extraction techniques."

In April 2024, Chile's national mining company Enami announced that it would consider 30 proposals from 12 countries to deploy DLE technologies at its US\$1.5 billion Salares Altoandinos project in the Atacama region. Summit Nanotech was one such proponent.

Argentina

Argentina, currently producing 34,000 t/y of lithium, is on track to become the world's third largest producer by 2027, with the potential to increase output to 260,000 t/y, indebted to the 18 projects forecast to start production by 2027, according to analysis by CRU. Mergers are helping the industry acquire speed. Finalized in early January 2024, the merger of Livent and Allkem is the largest such event in the lithium industry's history. The combined entity, Arcadium Lithium, according to the company's estimates, will be the third largest lithium producer by capacity in 2027.

In April 2024, Elon Musk and President Javier Milei met to pledge cooperation to enhance free-market principles and explore lithium mining opportunities. Despite the buzz, the meeting likely does not signify much. As outlined in the Argentinian constitution, natural resources are the property of the provinces. While Milei can set the national mining policy and promote investment, ultimately, decisions are made at the province level. Yet, Milei's enthusiasm will be beneficial. "The current government's commitment to attracting large-scale mining investments is crucial, given the substantial

capital required for development," said Ignacio Fernández, general manager LATAM at Terra Nova Technologies.

Despite growth, the country faces challenges: "One major hurdle in Argentina is the importation of sophisticated mining equipment, which may not be readily available locally, coupled with currency mobility issues," continued Fernandez.

The rapid development of the sector could also lead to infrastructure and logistics bottlenecks, as many operations are in remote regions of the country.

Bolivia

Bolivia possesses the world's largest share of lithium reserves, amounting to 24% of the world's total. Despite vast reserves, Bolivia has struggled to capitalize on its lithium potential compared to its neighbors, largely due to extraction method challenges and conflicts with indigenous communities.

The Bolivian government has shown a renewed commitment to the metal, aiming to generate US\$5 billion from lithium sales by 2025. In July 2023, Bolivian state-owned Bolivia Lithium Deposits (YLB) identified new lithium resources, bringing the total to 23 million t of identified resource. In January 2024, Bolivia's government signed an agreement with Chinese consortium Catl, Brunp, and Cmoc (CBC) to develop a US\$90 million pilot plant to extract and process lithium at the Uyuni Salt Flats, with an initial production capacity of 2,500 t/y of lithium carbonate. The plant plans to yield first lithium by year end 2025.

The global white gold rush has begun, and the lithium triangle has ample expertise, reserves, and technologies to meet the world's evolving needs. ■



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“

In 2023 alone, investment in research and development of proprietary processes reached US\$40 million.

”

Carlos Díaz

Executive Vice President of Lithium
SQM

Can you discuss SQM's performance in 2023 and recent achievements?

2023 was a year of significant achievements for SQM. The agreements reached with Ford Motor Company and LG Energy Solution not only strengthened our leadership in the lithium industry but also boosted the transition towards more sustainable global mobility. The choice of these leading companies shows confidence in the high quality of our products.

Can you provide highlights from the MOU between SQM and Codelco and how the partnership will enable SQM to produce lithium sustainably?

The recent signing of the partnership between Codelco and SQM allows Chile to maintain its leadership in the global lithium market through the sustainable production of lithium in the Salar de Atacama, extending until 2060. This provides operational continuity and enables long-term investment and customer contract projections. It is excellent news for Chile and the world. The Codelco-SQM partnership aspires to a total additional production for the period 2025-2030 of 300,000 t/y of LCE and 280,000 to 300,000 t/y of LCE between 2031 and 2060, and Chile will receive 85% of the operational margin through various channels from 2031 onwards.

Can you comment on the current regulatory environment in Chile in the lithium space?

The regulatory environment in Chile for the lithium industry has been constantly evolving, driven by the growing global demand for lithium and the need to ensure sustainable and responsible development. Current regulations aim to maximize economic benefits for the

country while minimizing environmental impact and promoting the well-being of local communities.

What is the significance of SQM's Salar de Atacama operation achieving the IRMA 75 certification, and what are the key factors and efforts that contributed to this recognition?

Achieving IRMA 75 for our lithium operations in the Salar de Atacama is a significant accomplishment and demonstrates the hard work of the entire SQM team. Committing our lithium mining operations to an IRMA audit and sharing the results transparently reflects our desire to improve and maintain an open dialogue with all stakeholders.

Key factors contributing to this recognition include our ongoing efforts to become the world's most sustainable lithium source. This involves not only meeting high environmental standards but also actively contributing to the communities surrounding the Salar de Atacama.

How is SQM innovating its lithium extraction and processing techniques to stay ahead in the competitive landscape?

At SQM, we are constantly innovating lithium extraction and processing techniques through various strategies to stay ahead in the competitive landscape. We have the SQM Lithium Ventures corporate venture capital program in partnership with Endeavor, which aims to bring together companies solving problems in the water, lithium, and electromobility verticals.

We are proud to have entrepreneurs whom we see as a complement to what we are creating, with very disruptive ideas that will help us understand new

technologies and leverage their creations with our knowledge.

How does SQM view the future of lithium and what are the company's plans to maximize returns?

At SQM, we see the future of lithium with great optimism, driven by the growing global demand for electric vehicles and energy storage technologies. To maximize returns, the company is expanding its production capacity and investing in advanced and sustainable technologies. In 2023 alone, investment in research and development of proprietary processes reached US\$40 million. In recent years, we have completed over 70 conceptual and laboratory studies with varying levels of progress and depth, according to the potential success of different brine extraction techniques. Additionally, we have made advances in production processes to improve our efficiency. From these technologies, a dozen pilot-scale studies have been defined in collaboration with various companies in the field, which are in the process of being completed.

It is essential to note that the current production and environmental authorizations create a framework of commitments that SQM fully complies with and that set limits on the size of tests to be developed with new technologies. In parallel, SQM has established long-term strategic alliances with key companies like Ford and LG Energy Solution, diversifying its lithium product portfolio and ensuring a stable market. It also maintains a strong commitment to social and environmental responsibility, collaborating with local communities, which strengthens its reputation and social license to operate. ■



Lithium Exploration

South America's white gold rush has begun

In 2030, global demand for lithium is expected to exceed 2.4 million t/y of lithium carbonate equivalent, doubling the demand forecast for 2025. "If the world wants to evolve into a green energy economy, it will need every single lithium project that is currently on the slate to come into production," said Steve Kesler, executive president at CleanTech Lithium.

Chile

Chile has 69 saline environments; in 2024, the government declared 31 protected, two strategic (requiring state-owned Codelco or Enami to be a majority partner) and five with a Codelco and Enami presence, but not necessarily as a majority partner. This leaves 31 salt flats for exclusive private entity development. "Now that the government has defined the rules of the game and eliminated the elements of uncertainty, investors are starting to make decisions," said Joaquín Villarino, executive president at Consejo Minero.

On April 15th, 2024, the government launched a request for Information (RFI) process for investors and private companies. The process lasted 60 days, and the results were announced in July. 54 firms from 10 countries submitted statements of interest to develop 88 projects. Any company can purchase lithium concessions in an area if it does not have other mining claims. The company must be granted a Special Operation Contract for Lithium (CEOL) by the government. "This news will allow us to define the lithium deposits for which the State will begin the process of awarding CEOLs, after carrying out an indigenous consultation process where applicable," explained Minister Aurora Williams in the press release.

This should also help advance late-stage projects like Cleantech Lithium's Laguna Verde and Francisco Basin,

which resubmitted their CEOLs in April 2024 and will contribute a minimum annual production of 20,000 t of lithium carbonate each, according to Kesler. The firm also inaugurated a DLE pilot plant in Copiapó in May 2024.

In March 2024, Lithium Chile entered a Farm-In agreement with France based Eramet in four of the company's Chilean properties covering an area exceeding 40,000 ha. Eramet will conduct a three-phase exploration program over 3 to

4 years, with a total projected cost of approximately US\$20 million. Lithium Chile's flagship project, however, is located across the border in neighboring Argentina.

Argentina

Argentina may match Chile as Latin America's leading lithium producer by 2030. The country holds 21.5% of the world's global lithium resource. Underground resource wealth, however, is no



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guarantee of success. Above ground regulations and initiatives are the only way to advance the sector. As defined by the constitution, Argentina's natural resources are controlled at the provincial level. In 2021, the leading provinces of the lithium industry in Argentina—Salta, Catamarca and Jujuy—signed the interprovincial treaty creating the Lithium Mining Region to promote the economic and social development resulting from the extraction, production, industrialization and commercialization of the mineral, its products, and derivatives.

Salta-ing to new heights

One of Argentina's most advanced mining provinces is Salta, which is home to prominent companies Livent and Allkem (now Arcadium Lithium). The province houses a portfolio of 24 advanced lithium exploration projects, five pilot plants and three more in construction. "Salta stands out as one of the most mining-friendly jurisdictions, not only within Argentina, but also in the broader region. The provincial government of Salta actively supports mining endeavors, ensuring that regulatory processes are carried out

efficiently," said Gabriel Rubacha, CEO and founder of NOA Lithium Brines, an exploration company with three assets in the province.

The company recently delivered its maiden resource for its flagship project, Rio Grande, "This showcases approximately 2.3 million t of lithium carbonate equivalent (LCE), with around 1.5 million t categorized as measured resources," said Rubacha.

Also among Salta's 24 projects is Lithium Chile's Arizaro project, which received preliminary results from its prefeasibility study supporting a 25-year mine life with 25,000 t/y production. "We observed preliminary results indicating a 5-10% increase in economic confidence over the PEA, which valued the project at US\$1.8 billion with an 8% discount rate and 29% pre-tax IRR. The pre-feasibility has successfully reduced OpEx from US\$5,300/t to US\$ 4,200/t," Steve Cochrane, president and CEO commented.

American Salars Lithium is a new entrant in the province. "We published a maiden resource of 760,000 t lithium carbonate shared with our neighbor at Pocitos 1, and 457,000 t lithium carbonate on the Candela II project on the Salar Incahuasi," said Nick Horsley president and CEO.

Leaving a (Cata)-marca

At the end of 2023, Catamarca had a portfolio of 22 mining projects: two in production, three lithium projects under construction, and three in advanced-stage exploration, and 14 early-stage projects. Among those are Arcadium Lithium's (previously Livent) Fénix and Sal de Vida (previously Allkem) projects.

The one advanced stage lithium exploration project is Lake Resources' Kachi project. "We completed work up to the Definitive Feasibility Study (DFS). The Kachi reservoir boasts 10.2 million t of LCE. Our brine quality consistently averages 250-300 mg/L," said David Dickson the CEO.

Lake Resources partnered with Lilac Energy Solutions to create a pilot plant. "This processed 500 million liters of brine to produce over 200,000 liters of lithium chloride. From this, we converted 2,000 liters into battery-grade lithium, achieving an impressive 99.9% purity. The plant aims to produce 25,000 t/y of LCE," said Dickson.

Developments in the lithium triangle underscore the region's crucial role in meeting the growing global demand for lithium as the world transitions to a green energy economy. ■



Gabriel Toffani

CEO
ADIONICS

Can you discuss Adionics' key milestones in 2023, including its collaboration with SQM?

In 2023, Adionics transitioned from a research-focused entity to an industrial player by implementing three industrial pilots. We have a mathematical model predicting process outcomes and estimating industrial plant costs based on the quality of the lithium brine provided by our clients.

Our first laboratory pilot, called Clean Lithium 1 located in our Paris headquarters, can produce 1 t/y of lithium. When a client wants to verify the mathematical model's results, they send us brine samples, and we conduct initial tests in this laboratory. We also have two CL15 pilots, capable of producing 15 t/y of lithium. In 2023, we conducted successful tests with one of these pilots in the Atacama Desert in collaboration with SQM. Initially, we carried out 500 hours of continuous testing, and after confirming the results, SQM invested in Adionics. We raised over US\$27 million in funds, with contributions from our historical shareholders and from SQM, which became our major shareholder. Subsequently, we conducted an additional thousand hours of continuous testing at the Atacama pilot to evaluate the conditions necessary for transitioning to an industrial scale.

Can you explain how your Flionex technology works?

Flionex is created chemically in a laboratory from several proprietary compounds. To extract the lithium from brines, it is simply mixed with the raw brine at room temperature using standard mining industry equipment. It is highly selective as it extracts primarily lithium with minimal amounts of other elements present in the brine, eliminating the need for costly purification stages.

The process consists of three stages: extraction, washing with fresh water to remove impurities, and regeneration by heating the Flionex to release the concentrated lithium. Flionex operates in a close circuit, minimizing water consumption and ensuring high energy efficiency. The process does not alter the nature of the residual brine, making it suitable for reinjection into aquifers, in compliance with environmental regulations. ■



Amanda Hall

CEO and Founder
SUMMIT NANOTECH

Can you introduce Summit Nanotech?

We launched Summit Nanotech six years ago to address the opportunities in the lithium market. We have honed our direct lithium extraction technology, denaLi™, to meet the environmental and community needs of Chilean and Argentinian lithium miners. We recently moved our pilot from La Negra to Santiago, building a large tank farm for brine storage and collaborating with local engineers to adapt the site for processing field brines. Our recognition as a 2024 Global Cleantech 100 company underscores our leadership in sustainable innovation.

Our joint venture with Power Minerals and Cobax Mining marks significant progress. We aim to develop these projects responsibly, focusing on community well-being, environmental sustainability, and economic efficiency, setting a precedent for responsible lithium extraction in the region.

What is denaLi™ competitive advantage?

denaLi™ is our sorbent-based technology. Our approach sets us apart from other sorbent DLE companies by achieving high yields and purity with minimal water and energy use, producing low waste, and requiring less land.

Our sorbent is aluminum-based, chosen for its readily available, and easily sourced raw materials. Aluminum-based sorbent offers leading performance in lithium separation while eliminating the need for acids, bases, or reagents on site, which contribute to its longevity. We engineered our sorbent to be more durable than typical ones, enhancing its lifespan, improving particle distribution and flow dynamics within the columns.

What is Chile's potential in the lithium space?

There is enough lithium in Chile alone to satisfy the world's needs, which can be sourced entirely from brine. We aim to cease hard rock lithium mining altogether, an invasive process requiring significant energy, water, and heat. The global shift towards brine processing presents an opportunity for Chile. As EV and battery manufacturers evolve in their supply chain decisions, the appeal of sustainably sourced lithium will become increasingly apparent, making it a preferable choice for their production supply chains. ■

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Gabriel Rubacha

CEO & Founder
NOA LITHIUM BRINES

Could you provide a brief introduction to the company and its assets in Argentina?

During 2022, we acquired mining properties mainly in three salars in the Province of Salta: Rio Grande, Arizaro, and Salinas Grandes, totaling approximately 140,000 hectares. We listed on the TSX via a reverse takeover in March 2023 and began exploration in Rio Grande, where we drilled five holes across different areas. In February 2024, we published our maiden resource for Rio Grande, totaling 2.3 million t LCE with an average concentration of 612 mg/L. These results place us in the mid to high range concentration of lithium compared to other explorers and producers in Argentina. Our portfolio includes Rio Grande with 37,000 hectares, Arizaro with 78,000 hectares, and Salinas Grandes with 10,000 hectares, where exploration will begin after completing the next stage in Rio Grande.

What are NOA Lithium's goals?

Our focus for 2024 is to publish an updated 43-101 resource report for our Rio Grande project, incorporating data from exploration, water exploration, pumping wells, and engineering studies. ■



David Dickson

CEO
LAKE RESOURCES

Can you introduce Lake Resources?

Lake Resources' intent is to become a battery-grade lithium carbonate producer utilizing DLE technology. Our principal asset is the Kachi project located in the Catamarca province of Argentina. As of December 2023, we completed work up to the DFS. The Kachi reservoir boasts 10.2 million t of LCE, predominantly categorized as measured and indicated resources. Our brine quality consistently averages 250-300 mg/L.

Throughout 2023, our focus remained on completing exploration, valuation activities, and demonstrating the efficacy of our DLE technology. In March 2024, we submitted our Environmental Impact Assessment (EIA), anticipating the approval process to span 12 months. Looking ahead, Lake Resources aims to secure necessary approvals and partnerships by 2025, advancing to Final Investment Decision and commencing production by late 2027.

What is the development plan for the the Kachi project?

The DFS was conducted based on a long-term lithium price forecast of US\$30,000/t, which we anticipate the market reaching by 2028, due to an expected supply-demand imbalance. The project's projected NPV exceeds US\$2 billion, with CapEx estimated at US\$1.38 billion and OpEx at US\$6,000/t. ■



Nick Horsley

President and CEO
AMERICAN SALARS
LITHIUM INC.

Can you introduce American Salars?

Our primary focus is the development and exploration of the Pocitos 1 & Candela II Salar projects within the Salta Province of Argentina. Spanning 800 ha and 3,000 ha respectively, both projects recently underwent an initial exploration phase, revealing a promising maiden resource of 760,000 t lithium carbonate shared with our neighbor at Pocitos 1, and 457,000 t lithium carbonate on the Candela II project on the Salar Incahuasi. We are currently planning further exploration efforts to expand those resources. We are actively seeking out more opportunities to acquire salars throughout Argentina.

What are some of the highlights at the firm since September 2023's Mineral Resource Estimate?

We have made significant progress in our mineral research, drilling five holes, and encountering lithium brines at depths of 200 to 250 m. The observed grade is 172 PPM. Our project targets a 400-meter-deep aquifer, aligning with our neighbor Ganfeng Lithium's successful results on the same salar. Gathering more porosity data is a priority to enhance resource reporting from inferred to measured and indicated resources. ■



Steve Kesler

Executive Chairman
CLEANTECH LITHIUM

Can you provide highlights from 2023 for Cleantech Lithium?

We published two scoping studies for our two main projects. Since declaring our initial resource at Laguna Verde, we increased the resource to 1.8 million t. We also declared a resource of 0.92 million t of LCE at Francisco basin for the first time. We acquired two other exploration projects in Llamara and Salar de Atacama. We are a pioneering force in the development of Direct Lithium Extraction (DLE) in Chile and completed the construction of a pilot plant at our facilities in Copiapó ready for commissioning in Q1 2024, which is designed to produce up to 1 t per month of battery-grade lithium carbonate once in operation. This further de-risks using DLE as a workable technology for the Salars in Chile. We also submitted our Special Lithium Operating Contracts (CEOLs) applications for both projects and looking to work with the government to meet their target for new lithium projects running in the next couple of years.

What are the highlights from the scoping studies at Laguna Verde and Francisco Basin?

CleanTech Lithium expects a minimum considered production of 20,000 t/y of lithium carbonate each from both Laguna Verde and Francisco Basin. In 2023, predicted CapEx was C\$400 million for Laguna Verde and C\$450 million for Francisco Basin. Operating costs stand at about US\$4,000 per tonne, against lithium's long-term price forecast of US\$22,500 per tonne. The Scoping Study attributed Laguna Verde with a Combined NPV for the two projects of was \$1.3 billion and with a 45.1% IRR, post-tax and royalties.

How is CleanTech Lithium adapting to Chile's government lithium strategy?

The government's aim is to protect 30% of the Salars in Chile and we expect our applications to be processed as soon as the Government has completed its work to identify which salars are to be protected and which can be exploited for lithium. ■

What are recent highlights at Lithium Chile's Chilean assets?

The moves toward privatizing lithium production and promoting joint ventures points towards a promising direction. The next white gold rush will be Chile, now that there is a pathway to develop, produce, and sell lithium in the country. Our six-year presence in Chile positions us advantageously, backed by a robust portfolio.

Eramet is an outstanding partner, with a firm commitment to Chile, evidenced by their US\$8 million allocation to advance lithium projects in the region. With the French government owning 27% of Eramet, our collaboration extends from government to government. We are proud they found four of our projects attractive, and there is potential for further partnership.

Summit Nanotech has been an excellent partner for the past four years. Their partnership is a natural evolution of our relationship, allowing us to benefit from their DLE technology while supporting their efforts to establish and expand a lithium resource.

Can you provide highlights from Arizaro?

We observed preliminary results indicating a 5-10% increase in economic confidence over the PEA, which valued the project at US\$1.8 billion with an 8% discount rate and 29% pre-tax IRR. The pre-feasibility has successfully reduced OpEx from US\$5,300/t to US\$4,200/t, marking a 20-25% improvement in cost per metric ton produced.

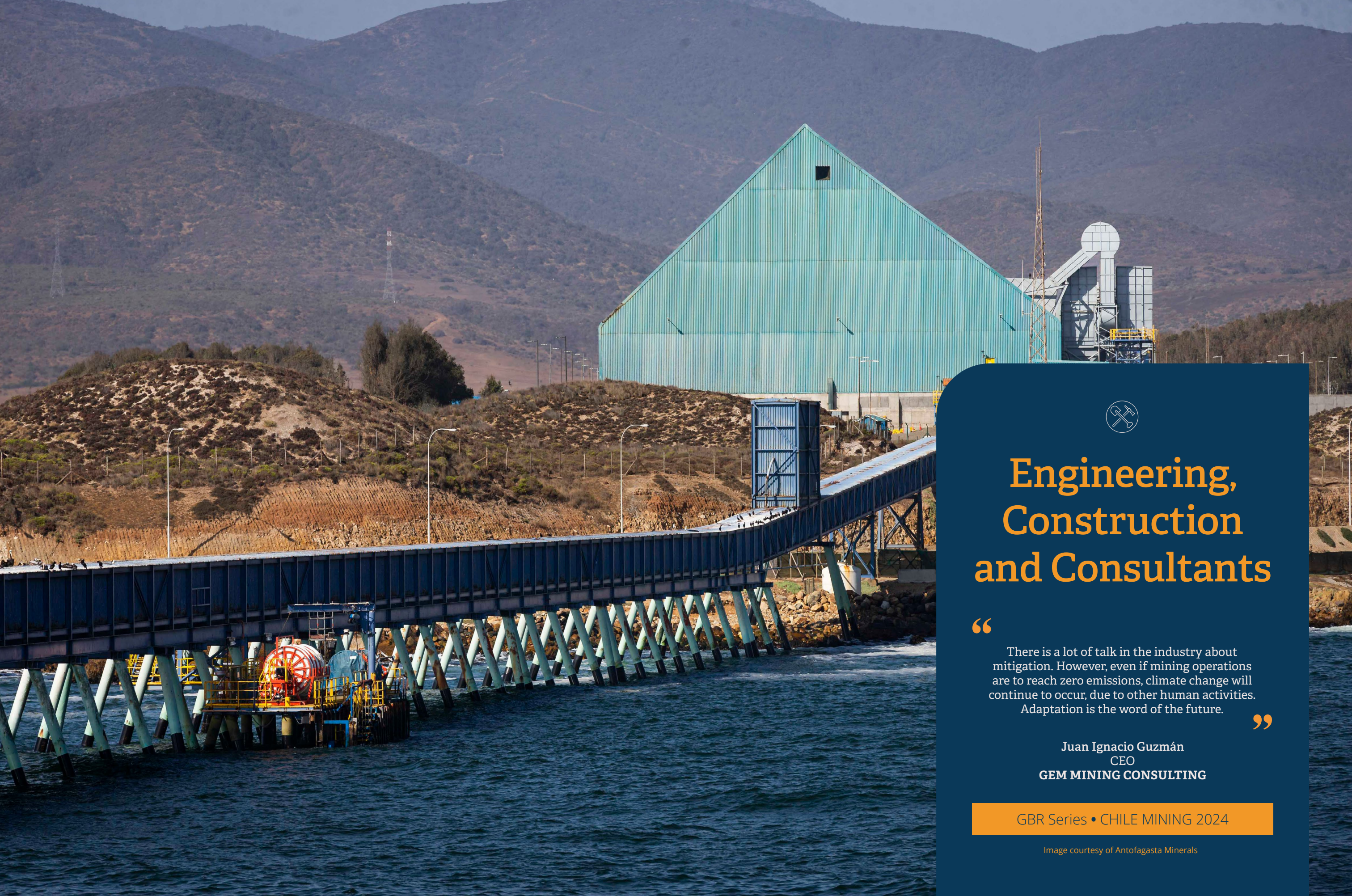
We can support a 25-year mine life, and 25,000 t/y have been supported by the reserve numbers in the pre-feasibility. Our initial PEA in April 2023 estimated a 30-year lithium price at US\$21,000/t. The latest forecasts have revised this figure upward to US\$29,000/t, reflecting a 30% increase in long-term price expectations over the past year.

The numbers for the pre-feasibility are based on the original 3.3 million t of measured, indicated, and inferred resource. It has not taken into consideration the additional 750,000 t we added in our updated 43-101 or the additional 8,400 hectares acquired from Remsa in December 2023. ■



Steve Cochran

President and CEO
LITHIUM CHILE



Engineering, Construction and Consultants

“

There is a lot of talk in the industry about mitigation. However, even if mining operations are to reach zero emissions, climate change will continue to occur, due to other human activities. Adaptation is the word of the future.

”

Juan Ignacio Guzmán
CEO
GEM MINING CONSULTING

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Image courtesy of Antofagasta Minerals



Climate Change Adaptation

Preparing Chile's mines for the future

Climate change has magnified its grip on Chile, with central regions enduring a surge in temperatures of 1-2°C above the norm (1981- 2010) in 2021—surpassing the continent's average uptick of 0.36°C, according to the World Meteorological Organization. The persistent and proactive adaptation of Chile's mining sector to these evolving climatic conditions has not only fortified its resilience but also established the nation's mining industry as a vanguard in climate change adaptation, largely attributable to the innovative strategies implemented by its engineering, consulting and construction firms.

Heavy rainfall in 2023 dampened productivity efforts. State-owned Codelco suffered losses of 7,000 t in 2023—2,000 t from the El Teniente mine and 5,000 t from the Andina mine—due to June's heavy rainfall. "The flooding increased operating costs by 10%, and reduced annual production by 5%," highlighted Juan Ignacio Guzmán, CEO at GEM Mining Consulting.

Heavy rainfall is not uncommon in Chile, given the region's exposure to the El Niño phenomenon, which disturbs normal weather patterns, leading to periods of intense precipitation in some areas and drought in others. Yet recent years have seen heightened effects of the changing climate. "The El Niño phenomenon has existed for centuries since it has to do with the heating of the water and currents. The difference today is that these processes are happening more quickly. Before the climate would fluctuate between the El Niño and La Niña phenomenon every few years. Now, the climate alternates between these two phenomena twice in the same year. It is not that there are new events, but rather these events will be more intense. Rains will be more intense. The heat will be more intense. The industry must manage its design criteria to associate with this intensity," said Mario Lazo Emparanza, regional manager at Knight Piésold.

An example was seen in 2023. "In 2023, recorded rainfall at Minera Valle Central (MVC) was 780 mm, which is around six times more than we experienced in 2019," said Aurora Davidson, CEO at Amerigo Resources.

Amerigo Resources produces copper and molybdenum through its wholly-owned subsidiary MVC, utilizing waste materials from El Teniente. "Given the impact of the rains, MVC saw a 10% drop in production in 2023 in comparison with 2022."

Disruptions at MVC have the potential to be devastating, as it is the direct link between the El Teniente mine and tailings deposit. Adaptive measures, therefore, were implemented. "We installed flotation equipment around the pipes that connect Cauquenes to our plant. We wrapped kilometers of pipe infrastructure in protective equipment. Without these measures, the flooding incident would have necessitated a complete halt in production from Cauquenes," said Davidson.

To operate in the future, climate change mitigation will not be a choice, but a necessity, said Carolina Páez, mining

manager at WSP: "Rains and floods are going to happen with higher frequency and intensity. Visible effects of climate change are bringing the industry to agree with our vision; projects must be designed with the effects of a changing climate considered."

At WSP this consideration has become a methodology called Future Ready, said Juan Ignacio Ríos the firm's general manager: "Future Ready is WSP's global innovation and sustainability framework. It enables us to design to both the current code and for our future world."

Ausenco is also helping clients understand the long-term impacts of changes in climate on the design and operation of mines. According to Florencio Castro, the president of minerals and metals in South America: "Chilean clients have been very proactive in addressing these issues, and we see many operations already taking steps to mitigate those risks."

Heads or tail-ings

Floods are not the only climate change induced phenomenon Chile's miners have to adapt to. The country has officially been in drought since 2010— water availability is down 37% in the last 30 years and is predicted to drop by 50% in northern and central Chile by 2060. Lack of water supply led Anglo American's Los Bronces production to drop 32% to 57,200 t/y in 2023. Scarcity induces change. "Chilean engineering firms are helping reduce water consumption, using water recirculation in the plant, covering industrial pools to reduce evaporation, and exploring new supply sources such as desalinated water," listed Iván Rayo Villanueva, general manager at JRI Ingeniería. "However," he continued, "these solutions also have limitations in terms of cost and availability."

To mitigate water loss, Anglo American's Los Bronces operation tasked LEN Ingeniería with preventing water evaporation from tailings tanks, resulting in the world's first floating solar plant on a tailings tank. "This innovation links an environmentally questionable area with a green solution, making use of otherwise wasted and contaminated space" said Julián Alvear Fernández, the CEO. "Covering the tailings tank with floaters can save up to 80% of water," he continued.

Other mines are also exploring alternatives to mitigate water loss. Luis Arcos, mining leader and key account manager of BHP at Stantec, said: "One way is through minimizing the size of tailings deposits. At Spence (BHP), for example, tailings deposits were designed in cells, which reduces the amount of evaporation that will occur."

Chile's miners are also adopting alternatives such as paste, co-disposal, filtered, or thickened tailings. Dry stack tailings permit the recovery of the maximum amount of recycled water. At Anglo American's El Soldado 150,000 cubic meter Hydraulic Dewatered Stacking tailings facility water recovery measured 80%. "However," said Arcos, "a challenge with filtered tailings is their lower production rate compared to standard mining operations. The largest filters can process 20,000 t/d, meaning multiple units are required to scale up to the operational volumes typical of major mines, such as 200,000 t/d."

"Instead," noted Hugo Andrade, General Manager at SH-IMIN, "large-scale copper mining is exploring alternatives such as thickened tailings – a middle-ground technology that reduces water content by approximately 10%."

Another alternative, being used at Mantos Blancos (Capstone Copper), is tailings treatment plants that use hydro-dewatering screens. Dolores Requena, general manager at ERAL, said: "This circuit offers several advantages compared to conventional methods, such as paste thickeners and belt filters. It is more economical and cleaner, with low energy consumption and maintenance, and enables the recovery of a significantly larger volume of water."

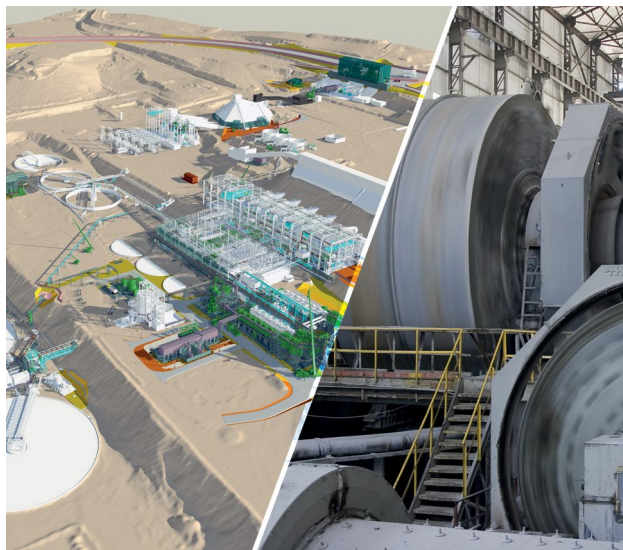
Desalination has gained traction as a viable solution to counteract the water crisis, which will be explored in depth in the subsequent article.

Solutions in action

More frequent and severe extreme climate events increase the vulnerability of infrastructure and escalate annual maintenance costs. Systra-subterra developed Climateplus, a web-based solution to anticipate the evolution of long-term climate conditions according to Intergovernmental Panel on Climate Change scenarios and validated climate models. "This tool evaluates the impact of climate change on specific geographical locations by varying temperature parameters, wind speed, and other climatic indicators to ensure our designs are resilient to climate impacts," explained José Miguel Galera, CEO of Systra-subterra, a part of the Systra group.

Climate change adaptation means taking decisive steps, says Andrea Casciano, country director and vice president operations Chile at Worley: "Our ambition is to be recognized globally as a leader in sustainability solutions in the

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Florencio Castro

President South America, Minerals & Metals
AUSENCO

What are some recent highlights from Ausenco?

2023 was a year of exceptional growth for our Chile operation, driven by various studies and projects for major mining companies like Codelco, Teck, BHP, Glencore, Collahuasi, and Anglo American, as well as other firms. As we move into 2024, our focus has been on project execution, with the Mantoverde project being one of the biggest highlights. As we near completion, this will mark a significant milestone for our Chile operation, as our first major project in the country.

At Mantoverde, we are executing the full spectrum of engineering, procurement, and construction (EPC) for the project, including everything from initial design and procurement to managing construction, commissioning, and project wrap-up. Across other projects, our involvement varies from conceptual design to feasibility stages, including pre-feasibility studies. We have also been providing operational support, including commissioning and ongoing operational assistance.

What is currently driving demand from mining clients?

We are seeing increasing demand from clients for assistance with decarbonization, tailings management, and resource efficiency. And they are looking to work with companies that embrace a forward-thinking, innovative approach.

How does Ausenco help address the challenge of declining ore grades?

We focus on finding alternatives and

“ We are seeing increasing demand from clients for assistance with decarbonization, tailings management and resource efficiency. ”

leveraging technology to optimize efficiency and defer investments. Instead of immediately expanding with new infrastructure, we explore ways to process existing resources more effectively. This involves using available technologies such as coarse particle flotation, ore sorting, and dry stack tailings to minimize water consumption. By implementing these strategies, we aim to reduce the need for large capital investments while still delivering results. For new projects or expansions, we prioritize cost-efficiencies to minimize financial risk in uncertain markets. Our approach is centered on understanding our clients' business needs and conserving capital resources whenever possible.

Could you discuss Ausenco's commitment to sustainability?

We are doing several things to help our clients meet their sustainability goals, like reducing energy and water usage. We design mines that require less material, such as concrete and steel. We look at electrification and the use of hydrogen in trucks and measure the impact on emissions using our proprietary tools. Internally, we are also focusing on improving our own environmental impact as a company. It is not just about helping others but also taking leadership in reducing our environmental footprint.

What is the potential of renewable energy use for Chilean mines?

Most mines now source their energy requirements from renewable sources because it makes sense from both a sustainability and business point of view.

The first step is to optimize energy use in operations, then source the remaining energy from renewable sources.

How are Chilean mines adjusting to the challenges posed by climate change?

We have been helping our clients understand the potential long-term impacts of climate change and how they might affect the design and operation of mines, including changes in water availability, temperature changes or others. Chilean clients have been very proactive in addressing these issues, and we see many operations already taking steps to mitigate those risks. Our teams work to adapt designs to consider future climate conditions and ensure that operations can continue to function effectively under changing conditions. This involves looking at infrastructure, water management systems and operational strategies to ensure resilience against climate change impacts.

How has the investment climate in Argentina evolved under the new government?

We are optimistic about Argentina's political progress. There is significant interest, especially in lithium and other minerals. Most of our studies for Argentina are currently conducted from Chile, but we also see growth potential in Argentina. It is a key region for us, with a focus on lithium and copper studies.

Can you talk about Ausenco's goals in Chile and the broader South American region?

In Chile, our focus is on sustaining growth and leveraging the achievements of projects like Mantoverde. Internationally, our presence is robust in Peru, where we are engaged in various projects at different execution stages, and in Colombia, where ongoing projects are underway. Brazil has witnessed rapid expansion, particularly in the studies sector.

Despite favorable market conditions presenting ample opportunities for new ventures, we face challenges with permitting processes that need streamlining. South America is abundant with mineral resources essential to meet global demand, but governments must ensure mining processes are facilitated efficiently while upholding regulatory standards. ■



Andrea Casciano

Country Director and
VP Operations Chile
WORLEY

“ We are bridging two worlds as we accelerate to more sustainable energy sources, while helping our clients provide the energy, chemicals and resources that the world needs right now. ”

Can you describe Worley's history in Chile and your current involvement in the mining sector?

Worley has a long trajectory in Chile, with over 60 years in the country. After multiple acquisitions, we secured our position as a major Chilean resource and energy sector player.

Santiago houses Worley's Center of Excellence for lithium, copper, underground mining, and material handling.

Worley's project portfolio is structured across three domains: engineering, framework contracts, and contracts in execution, with a significant emphasis on the mining sector, which represents more than 90% of our portfolio. The remaining 10% of our portfolio is dedicated to the renewable energy sector.

What was the impetus behind Worley's new brand presence?

Worley's rebrand showcases our commitment to sustainability. We are aiming to derive 75% of our revenue from sustainability-related work by 2026, and our ambition is to be recognized as a leader in sustainability solutions.

Right now, we are bridging two worlds as we accelerate to more sustainable energy sources, while helping our clients provide the energy, chemicals and resources that the world needs right now. Our visual identity reflects this challenge of contrasts.

What does Worley offer in the mining industry?

Our delivery model goes from engineering at study level to full delivery (procurement and construction) and consulting business. This holistic approach ensures that every phase of the mine life cycle is covered, leveraging Worley's global expertise to deliver sustainable and efficient solutions tailored to each project's unique needs.

What are the challenges and opportunities of working in Chile?

The challenges of working in the Chilean mining industry can be found within its opportunities. During the last years, the mining industry had a boom due to the global commitment to achieving net zero emissions by mid-century, creating a huge demand for energy transition commodities, such as copper and lithium. This offers an excellent opportunity for the

industry but also brings the challenge of being able to meet new, escalating demands according to the speed and quality that the market requires.

Also, even though our clients are willing to invest, particularly in copper and hydrogen, permitting is an issue. Hopefully the government initiative to streamline the process may change the current situation providing the necessary impulse to investment.

What recent achievements has Worley made in Chile to highlight its commitment to data-centric operations and sustainable engineering practices?

We have a strategic orientation towards sustainable innovation, working with our clients to design and deliver projects that incorporate the latest technological innovations and contribute to sustainable outcomes. In 2022, Worley became the first engineering company to acquire the BIM ISO 19650 certification in Chile, spotlighting our dedication to data-centric operations.

Also, we have a framework for all projects conducted by Worley where engineering is being undertaken: the Safe and Sustainable Engineering for Asset Lifecycle (SEAL) Standards. Its primary purpose is to help deliver an enhanced outcome for our clients via a methodical approach towards safety and sustainability.

Can you provide an example of one of Worley's ESG initiatives?

Our purpose, ambition, strategy, and values are all elements that help us stay on track and work toward achieving our goal of delivering a more sustainable world. As our industry and our purpose evolve, we are aware that we must reshape the way we act. To implement this change, we have created our ESG approach, that aims to make a positive impact on people, the environment and the communities we work in.

An example of this is our own sustainability commitment: reaching net zero Scope 1 and Scope 2 GHG emissions by 2030 and Scope 3 by 2050. We are implementing different actions in order to achieve this goal that are taking Worley in the correct track, as we had a reduction of 7% in Scope 1 and 2 GHG emissions, compared to 2023. ■



“

Work teams were strengthened and relationships with clients improved, resulting in a successful and high activity year.

”

Iván Rayo Villanueva

General Manager
JRI INGENIERÍA

Can you provide an overview of JRI Ingeniería (JRI)'s performance in 2023?

The year 2023 was exceptional for JRI, possibly with the highest engineering sales in our entire history. We carried out significant studies and engineering projects for Codelco, BHP, Anglo American, CMP and Capstone. We reached approximately US\$45 million in sales, a significant figure in the engineering field. Additionally, we strengthened our business units, exclusively focused on mining industry projects, including areas such as concentrator plants, underground mining, long-distance hydraulic transportation, and tailings design / management. Work teams were strengthened and relationships with clients improved, resulting in a successful and high activity year.

What are the most demanded engineering services by mining clients?

In the current context of high metal prices, mining clients are focusing on optimizing plant operations with prudent investments to improve processes, marginally expand capacity and capture economic benefits. These projects are rapidly executed to take advantage of favorable prices. Additionally, new mining projects are being developed to replace depleted operations and continue feeding plants. This is the case of Codelco, for example, which needs to incorporate more mines to maintain its operations in light of declining production.

On the other hand, water management is critical due to commitments made by mining companies to stop using continental water for legal, environmental and community reasons, as well as its scarcity caused by climate change. Desalination and water recirculation projects between the tailings dam and the plant have been undertaken, creating significant business opportunities for us. Furthermore, JRI is involved in structural engineering projects for Codelco, such as Chuquicamata Underground, Diamante, and Rajo Inca. We have also completed four tailings dam projects for Codelco at level of conceptual, basic and detail engineering.

Can you provide details of the studies JRI conducts for water optimization?

JRI has a research center with over 15 years of experience, focused on studying the rheology of tailings, incrustations, and hydraulic design optimization for transportation systems. This connection between the research center and the JRI company generates better solutions and designs for each hydraulic transportation system, optimizing the use of water in operations.

What alternatives exist for optimizing water use in mining?

There are several ways to optimize water use in metallurgical processes and hydraulic transport. This includes process optimization to reduce water consumption, water recirculation in the plant, covering industrial pools to reduce evaporation, and exploring new supplies sources such as desalinated water. However, these solutions also have limitations in terms of cost and availability. Engineering companies like JRI help clients develop optimization projects to address these challenges. For example, we are working on a project for Codelco's Andina Division to recirculate water between the Ovejería tailings dam and the concentrator plant, which presents significant technical challenges due to the altitude difference.

As the President of the Association of Consulting Engineers of Chile (AIC) what do you see as the main challenges and opportunities for engineering companies in Chile?

Despite the decrease in mining investment in the country compared to previous years, engineering companies have maintained high activity. This trend is expected to continue in 2024 and beyond, with increased demand for projects and engineering, especially in the mining sector. This will generate high levels of employment, and we are concerned about the potential shortage of specialized engineering professionals, especially in geotechnical, geomechanical, and underground mining. This is due to a lack of replacements for engineers who have pursued other activities during the pandemic and have not returned to the field of engineering.

What are JRI's objectives for the coming years?

JRI has a clear objective of strengthening its presence in the region. We already have an office in Peru, where we expect the mining sector to gain strength in the coming months, and plan to reinforce our presence in Ecuador, where we already have a partnership with a local company for project execution, and where mining is just beginning to develop. We also aim to increase our participation in private mining in Chile, with a focus on clients like BHP. Additionally, we want to explore opportunities in the non-metallic sector, such as lithium. Currently, we have 505 employees and new facilities, and we aim to grow by 10% compared to 2023. ■



Julián Alvear Fernández

CEO
LEN INGENIERÍA

How does LEN support the mining sector?

Our experience has positioned us well within the mining industry, where our road design expertise is recognized for its efficiency, safety, and sustainability, as well as our high effectiveness in managing environmental and sectoral permits. Thoughtful road designs directly impact carbon emissions in mines.

What factors led to LEN's development of the world's first floating solar power plant?

In 2019, LEN conceptualized, designed, constructed, operated, and maintained the world's first floating solar plant on a tailings pond at Anglo American's Los Bronces mine. This innovation connects an environmentally questionable area with an eco-friendly solution, utilizing space that would otherwise be wasted and contaminated. This ecological solution has attracted interest from clients like BHP, who have requested feasibility assessments for similar projects on other tailings ponds.

How has the demand for sustainable solutions unfolded in the mining industry?

Today, the demand for copper involves more than traditional metrics, emphasizing efficiency, productivity, and sustainability. Modern designs must not only ensure safety but also consider long-term impacts, such as fuel consumption by trucks using these roads. ■



Agustín Cabañas

General Manager
R&Q INGENIERÍA

What projects is R&Q Ingeniería (R&Q) involved in?

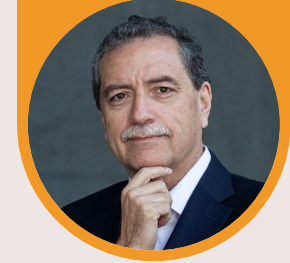
In the mining sector, we are completing the Quebrada Blanca project by Teck and complementary infrastructure (INCO) by Antofagasta Minerals, in addition to being involved in the most relevant projects currently under development in Chile, such as C20+ at Compañía Minera Colahuasi, Andes Norte-Nuevo Nivel Mina at El Teniente, Spence Tailings and Waste Management at BHP, Chuquicamata Subterránea Project (PMCHs) at Chuquicamata, among others. In these projects, the most significant challenges are to increase productivity and ensure compliance with cost and timing without accidents.

What services does R&Q offer the mining industry?

R&Q specializes in owner support services, becoming a strategic partner in project management by forming integrated teams to enhance project value, covering from profile studies to execution. We have expanded into Project Management Consulting, offering a 360-degree service model.

What challenges is the mining industry facing in Chile?

Chile is facing technical challenges presented by increasing ore depths, such as rock explosions and developing underground mines within existing frameworks, characteristic of Chile's aged deposits. ■



Víctor Contreras

General Manager
PARES&ALVAREZ

What has been the company's performance in the last year?

In 2023, we reached our peak in terms of size, sales, and activity. Our consulting and engineering areas were particularly strong, covering pre-feasibility studies, plant optimization, and detailed engineering. It was also a significant year for our environmental department. Moving into 2024, we have several important projects lined up for the coming months.

What are some of the main projects you are working on?

For the past 18 months, we have been working on a tailings dam project. We are also involved in Antofagasta Minerals' Centinela project, covering the coastal area and dock in an EPC format alongside our partner, Echeverría Izquierdo.

Last year, we also participated in several lithium projects as well as various desalination projects, working for a world known technology company. We also participated in Aclara's rare earth production project in Penco, though it is currently on standby.

What are the company's goals for the next two years?

Our goal is to maintain leadership in the Chilean market and to become the preferred option for mining customers. ■

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next five years, and for that we have a global target of deriving 75% of our revenue from sustainability related work by 2026.”

Equans extends the option of change to their clients. Diego Clavería, the company’s chief commercial officer, said: “Equans has integrated the option of reforestation into all its technical and commercial proposals as a core environmental initiative through tree planting efforts in Patagonia. Every proposal we submit includes a commitment to mitigate CO2 emissions generated by our fleet, which currently comprises 800 vehicles.”

Expertise kindled in the mining industry can be used to drive change. Cummins Chile collaborates with the Nature Conservancy Chile on a project for water resilience in the Maipo basin. Miguel Flores, the general manager, said: “Cummins invested US\$450,000 over 18 months in this project, leveraging technologies and telemetry to monitor key wetland variables remotely. It involved applying the technology developed for the mining industry to wetland conserva-

tion, demonstrating Cummins’ dedication to safeguarding vital natural resources.”

Mining’s climate strategy: more women

Adapting to climate change across the industry requires substantial shifts in its foundational structure, including increasing the representation of women in leadership roles. A study from BloombergNEF indicates that companies with higher female representation on their boards tend to enhance energy efficiency, lower environmental impacts, and invest more in renewable energy. Furthermore, women-led firms are more proactive in reducing emissions and achieve superior ESG scores compared to those led by men, according to a study by the European Investment Bank.

According to Ailie MacAdam, president of mining and metals at Bechtel: “Effective leadership of diverse teams leads to better outcomes. Female leaders often understand what it is like to feel excluded and can foster an inclusive culture where everyone can thrive.”

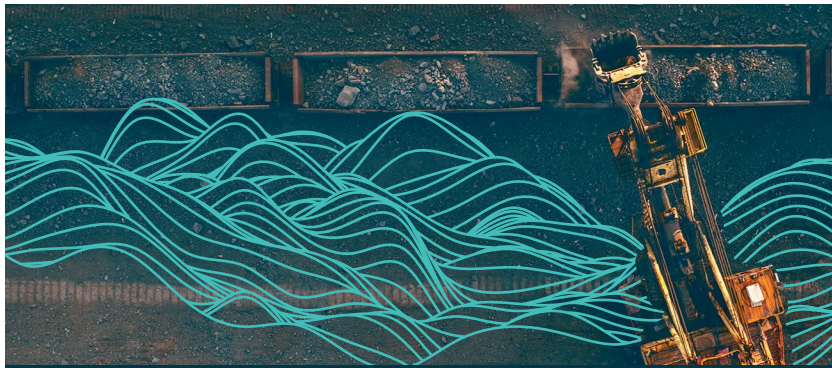
MacAdam is right. In February 2024, copper giant BHP reached 40% female participation across its Chilean operations and performed a study to measure the effects. According to the analysis, the teams with more women increased productivity by 11%, in addition to creating more inclusive, safe, creative, and high-performing spaces.

These findings underscore the potential leadership role of the Chilean mining industry in global climate initiatives in mining. The industry-wide average of female participation reached 14.8% in 2022, above the global average of 12%.

However, in Latin America, women only occupy 11.2% of leadership positions in publicly traded mining and metals companies, according to an analysis by S&P Global. To confront climate change this will have to change, but optimism abounds. “I am very proud to have been chosen as the first female CEO in the company’s more than 60-year history. As both the CEO of Sigdo Koppers Ingeniería y Construcción and as national counselor in the Chilean Chamber of Construction, I see a transformation of culture at the national level, with Sigdo Koppers acting as a pioneer,” said Caroline Vender. “The company trained nearly 6,000 women, encompassing professionals, frontline leaders, supervisors, and direct labor. Notably, we have initiated female welding programs in Brazil and Chile, along with electrical training initiatives,” she continued.

“Increasing female representation is a choice,” highlighted Agustín Cabañas, general manager at R&Q Ingeniería, a firm that achieved 25% female participation in 2023. “It involves training and including women in all aspects of operations. In recruitment processes, there always must be a female option. This approach opens the door for either gender to be selected, moving beyond a male-dominated selection process. It is about making a conscious decision to hire a specific number of women. Mining companies, like BHP, are openly committing to women constituting 40% of new hires. This policy is not just a statement; it is a deliberate strategy to ensure gender diversity.”

The climate will continue to change, and its effects will heighten across the globe. Chile serves as an example to the global mining community: to move forward the industry must adapt. ■



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JP

BR

SC

“Being at the forefront of green mineral production is part of Chile’s strategic positioning.”

Jérôme Pelletier, Benoît Richard and Stéphane Charest

JP: President and CEO
BR: Associate and Director Chile
SC: VP Decarbonization, Energy and Chemicals
BBA

Would you introduce BBA and its operations in Chile?

JP: BBA is a consulting and engineering firm, and we have been in Chile for three years. Our services can be categorized into four branches: consulting/advising, design, environment and operational support.

BR: In Chile, we started with providing a service for operational excellence, supporting our clients to improve their global efficiency in operations or in construction projects. So far, we have been successful in our mission to build a multidisciplinary engineering team and to reproduce our successful model from Canada in Chile. We offer environmental services (permitting, social and community guidance), mineral processing, geology and mining, mechanical, piping, electrical, automation, civil, geotechnical and tailings management services. BBA’s model has always been to focus on onsite presence. We support some of the major players, including Codelco, Teck, Glencore and Antofagasta Minerals (AMSA), as well as CMP in iron ore projects, but we want to extend support to all types of operations.

What trends are currently seizing the mining industry, particularly in Chile?

JP: There are major investments toward decarbonization. Our clients are improving their assets, plants and investments. All our clients have a 2050 net zero plan, with fixed targets for 2030.

Health and safety are paramount in mining, alongside the ongoing trends of digitalization and automation. With a scarcity of qualified personnel and

mines often located in remote areas, the industry is increasingly exploring automation solutions. Remotely run operations will become increasingly prevalent.

How are Chilean clients advancing with 2050 net-zero goals and how does BBA help?

BR: Some clients need us to put action behind the words of decarbonization. We guide clients in restructuring their own organizations and internal processes to allow decarbonization to flow from a high-level idea to on-the-ground action.

JP: New value chains are being built in every commodity: green copper, green iron, green aluminum, and more. Everything is becoming green. Our goal is to help clients bring to market these value-added minerals.

What differentiates Chile in the global mining sphere?

BR: Chile will become a pioneer in digitalization, adopting technology, decarbonization and ESG guidance, not only because the country has the expertise, but also because it’s necessary. Lithium is attracting global investments and copper has for years. Most international companies are in Chile. Chile is BBA’s first international expansion for a reason. We want to become an organization that is making a difference in the world, and Chile is the place to start.

SC: To produce the critical minerals needed for decarbonization, Chile benefits from sources of renewable energy. If you look at electrifying mineral-producing processes, the benefit of having wind in the south and solar

in the north is enormous. Being at the forefront of green mineral production is part of Chile’s strategic positioning.

What are BBA’s decarbonization initiatives?

JP: We committed to being net zero by 2030. Furthermore, we committed to compensate for all BBA’s past emissions. Last December, we announced our investment in Tree Canada. We’ve compensated for our emissions from the last 44 years.

BR: At BBA, net zero isn’t a high-level concept, rather it’s executed on the level of our employees. For example, our Connect platform enables employees to suggest ways our firm can improve. These initiatives have been executed.

What are BBA’s goals for the next three years?

JP: We will keep building our firm across Canada, as well as our international operations. There will be a new office in the USA in 2024, and likely more in 2025. Santiago is and will continue to be our South American hub, but, by 2027, we are looking to expand throughout the country to have easier access to our clients’ regional operations.

BR: In Chile, people are driven by saving the planet. We want to leverage local workforces. We do not want to grow for the sake of growing. We already serve clients in Argentina, Peru, Columbia, Brazil and Mexico, but Chile is the best place to do business. The expertise and potential are here. Our core strategy is to locally support our clients and, when possible, open offices locally, near their operations. ■

JIR



CP



Juan Ignacio Ríos and Carolina Páez

JIR: General Manager
CP: Mining Manager
WSP CHILE

What were WSP's highlights from 2023?

JIR: It has been an interesting year from the perspective of diversification: Our services fall into the niche of operation maintenance and our main business is related to tailings, but we made a big push into mining infrastructure, and this will continue to be a global focus for WSP. Today, we are proud to offer services from the port to the mine.

CP: 2023 was a year of consolidation and integration from recent acquisitions like Golder and the Environment & Infrastructure business of Wood. We consolidated our work in tailings to deliver a great service to our clients. Plant engineering is a growing area for WSP, this year we developed a desalination plant for Codelco's Radomiro Tomic, capable of processing 800 liters per second, expandable to double.

What projects is WSP currently involved in?

CP: Centinela approved a new US\$4.4 billion concentrator. Its construction was divided into vertical packages,

one of which included the construction of the tailings deposit. We are present in Quebrada Blanca II and Los Pelambres. In lithium, we work with Al-bemarle and SQM.

How do WSP's operations revolve around innovation and the Future Ready concept?

CP: Mining is a conservative industry but our Future Ready® program is beginning to resonate with our client's needs. We have been working for two years to incorporate this concept; we are at a point where clients are internalizing it and asking for small services that are directly oriented to the four trends our Future Ready® program analyzes: climate, society, resources and technology.

How does WSP help clients adapt to climate change?

CP: Visible effects of climate change are bringing the industry to agree with our vision; projects must be designed with the effects of a changing climate considered and our professionals are aware of this. ■

What services does Wood provide to the mining market?

Our services cover the entire mining process, from conceptualization to production and marketing of metals such as copper, molybdenum, gold, silver, and lithium. We are recognized for our expertise in managing mining projects, such as the successful Spence Growth Option (SGO) project with BHP and our current work with Antofagasta Minerals. We act as integration contractors, managing and administering projects for our clients.

How is decarbonization progressing in the mining industry, and what role is Wood playing?

We are advancing with green hydrogen pilot projects in the south of Chile, and we are working in a pilot plant for Anglo American. Globally, Wood has established a team dedicated to decarbonization, the D-Carb Team, focused on finding innovative solutions for the mining industry.

How do you perceive the adoption of new technologies in the mining industry?

Remote integrated operation centers, used by companies like Tech, Anglo

American, and BHP, show how technology has gained ground in the mining industry. Companies like Wood, with origins in the oil and gas sector, are transferring cutting-edge technology to mining.

Can you provide details on Wood's alliance with the University of Chile to drive innovative solutions?

We have a collaboration agreement with the Advanced Mining Technology Center (AMTC) of the University of Chile to develop innovative solutions to current mining challenges. We focus on "Fit for Purpose" solutions, suitable for optimizing long-term performance and maintaining business profitability. We are particularly involved in the development of technologies for lithium extraction, seeking more efficient and sustainable ways of operating, such as reducing water usage and mitigating environmental impact.

Additionally, we are exploring solutions for autonomous operation in underground mining, leveraging the AMTC's development of autonomous and robotic equipment. We also benefit from the AMTC's expertise in processing difficult minerals or those requiring more economical processing methods. ■



Manuel Viera Flores

CEO
METAPROJECT

“

Chile needs to perform a geological satellite exploration of every region, in order to have a country level masterplan. The south is underexplored.

”

How did the events of 2023 impact operations at Metaproject?

In 2023 the world was plagued with financial uncertainty, war, and, in Chile, there was much political instability and a reduction in investment. From the point of engineering, demand was reduced.

MetaProject implemented its new business model, that is, our clients knock on a single door and find all the solutions to their engineering problems.

Chile as a country did not offer great opportunities in 2023, so we looked abroad. We are forming an alliance between Chile and Peru, as Peru is a country that embraces mining. We also see Venezuela's rich mineral endowments as an opportunity.

What challenges is the Chilean mining industry currently facing?

Investors seek to invest in countries that give guarantees to their money, and Chile is losing business confidence due to innumerable tax and labor reforms, among others.

A lot of this has to do with recent tax reformations and the labor reform. To be the world's main producer of copper, the level of investment is comparatively low. Production rates are decreasing, and they will continue to do so. Chile is close to US\$24,000 per capita; it is almost a developed country. Due to political instability, we have not reached that point. Mining has the potential to change that; it is between 10-15% of Chile's GDP and brought million Chileans out of poverty.

How can Chile attract new investments and projects?

First, the country needs to perform a geological satellite exploration of every region to understand what minerals each one can offer. This will allow us to have a country level masterplan. The south is underexplored. However, what is the use of being rich in the subsoil and poor on the surface? Bolivia, for example, has one of the biggest lithium deposits in the world, but also immense poverty because it has not been exploited.

Secondly, Chile needs tax rules. Currently, the only way mining is approached financially is to increase taxes, which goes against growth. If there is no financial growth, mining cannot grow.

Finally, Chile must industrialize its mineral wealth and give tax benefits

to manufacturing companies that come to the country. Latin America possesses the most important raw materials in the world, but the countries sell it as raw material, not as a finished product. Selling the raw material creates employment for those who buy it, not those who sell it. Although selling raw material generates cash, revenue is lost in comparison to selling the processed product. This is not only a problem in Chile, but all Latin America.

Can you discuss planetary mining and the philosophy behind it?

In 2019, the United Nations reported that by 2050 many of the so-called critical minerals will run out due to the high demand and consumption. There are two alternatives to feed the growing electromobility industry and combat climate change: exploit minerals from the seabed, which would be suicide, or look into space and exploit asteroids or minerals on the moon and Mars. Here is where the so-called Planetary Mining is born, or Astromining. However, humans have already handled the ocean irresponsibly. Over one-third of marine mammals are threatened by extinction, and much of the ocean is polluted. To explore in the oceans, we would have to pollute the ocean more than we already have.

The foundational principle behind planetary mining is unrestricted respect for nature and the beings that live on Earth. Much of the damage humanity has done on earth is irreversible. We want to prevent creating a hecatomb. The earth is a home we have not cared for.

I helped found the Chilean Institute of Astromining to ensure our country is a pioneer in space mining. In Chile, we have the most important astronomical observatory in the world and the Atacama Desert is a natural experimental laboratory with its surface similar the moon and Mars.

What are Metaproject's objectives for 2024?

Create a Chile Peru mining alliance to take advantage of synergies and internationalize Metaproject. We are working with India, Turkey, Ukraine, and Canada to make this a reality. METAPROJECT is an Engineering and Innovation company.

And finally, to be the best mining and multidisciplinary engineering company in Latin America. ■



Business Insights on the Environment



Juan Ignacio Guzmán, CEO, GEM MINING CONSULTING

“Over the last 5 years, the effect of climate change on mining operations has become more prominent. For example, in 2023, a flood caused El Teniente to close for 6 months, increasing operating costs by 10%, and reducing annual production by 5%.”



Mark Wainwright, Managing Director - Mining, TURNER & TOWNSEND

“ESG awareness is intrinsic not only to shareholders and stakeholders but also to staff attraction and retention. The generation entering the workplace market has a high environmental consciousness.”



Hugo Andrade, General Manager, SHIMIN

“The mining sector is increasingly gravitating towards desalination as a vital water supply solution. Around 20 desalination projects are already underway in our mining sector, and several mining companies are considering new investments in this area.”



Mauro Mezzano, Founding Partner and Co-CEO, VANTAZ GROUP

“Until recently, miners focused solely on economics. Now, there are three intertwined objectives: economic, environmental, and social. The mining industry has set aggressive goals to be carbon neutral by 2050, at least in scope 1 and 2.”



Juan Carlos Soto Candia, CEO, DELPRO INGENIERÍA

“We aim for 70% of our collaborators to be local; a policy with a positive socioeconomic impact benefiting our clients and the community. This approach not only strengthens our relationship with the community but also enhances the sustainability of our projects.”



Water and Climate Change

Desalination and recirculation preserve Chile’s scarcest resource

Desalination has gained traction as a viable solution to counteract the water crisis caused by the country’s 14-year drought. Chile currently has 28 desalination plants either operational or under construction. These facilities have the capacity to produce 8,200 liters per second of fresh water, and projections indicate that this capacity will likely reach 25,000 liters per second by 2028. The growth of desalination projects aligns with Chile’s strategic move to diversify its water sources, as freshwater use is projected to decrease to 53% while seawater use will rise to 47% by 2031 in the mining sector.

In March 2024, Antofagasta Minerals inaugurated a US\$2 billion desalination plant at Los Pelambres. “The scale was substantial, involving approximately 7,000 rotations of direct craft professionals. Our scope included the construction of a desalination plant, a 64 km water pipeline and the establishment of a new concentrator featuring SAG and Ball Mill,” said Ailie MacAdam, president of mining and metals at Bechtel, the EPC firm contracted for the project.

Iván Arriagada, CEO of AMSA, provided further insight: “Expansion of the desalination plant to 800 litres per second will substantially reduce the need to extract water from continental sources, which have been impacted by the ongoing drought in the region. Importantly, this will help us advance toward our goal of 90% of water use coming from seawater or recirculated sources.”

The Collahuasi joint venture, the second largest producing copper mine in Chile, will be supplied “through a 194-km, 44-inch pipeline, with five pumping stations and other facilities up to 4,800 meters above sea level. This project is an essential part of Collahuasi’s mine life extension for an extra 20 years,” said Claudio Perillo, president of Andean region Techint.

However, “Transporting water from sea level, where desalination plants are, to altitudes of 3,000 or 4,000 m where many mines are located is challenging,” said Juan Castaño, CEO Chile at Amphos 21. “Artificial aquifer recharge, which Amphos 21 has been working on for over 10 years in Europe and Chile, is a solution for excess desalinated water. It helps recover aquifers and maintains a groundwater reserve, benefiting not just the mining

sector but also helps restore overall groundwater levels,” he continued.

The adoption of desalination technology is not without financial implications. Desalination plants require around US\$1 billion out of a US\$3-4 billion copper project’s CapEx. Furthermore, “The cost of seawater at US\$5 per cubic meter is 10 times higher than groundwater at US\$0.5, significantly raising operational costs,” said Juan Ignacio Guzmán, CEO at GEM.

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Yet, many miners will not have a choice. "As desertification progresses and water demands increase, the need for desalination is expected to intensify," said Víctor Contreras, general manager at Pares&Alvarez.

In March 2024 a Chilean law, Boletín N° 11.608-09, was proposed, aiming to streamline and regulate desalination projects. It updates maritime concession procedures to prioritize human consumption and ecological needs, and mandates environmental impact assessments for all desalination projects.

Much of the state's support comes from the proactive approach mining operations have taken to avoid social conflicts related to water, said Daniel Caro, general manager at BFS: "Multipurpose projects, like Aguas Pacífico Desalination plant, are pioneering and show how the demand for water in mining and communities can be reconciled."

Circulate to mitigate

Desalination is the focus for water use but does not entirely solve the problem, said Juan Cariamo Zerené, founding partner and co-CEO at Vantaz: "Mines must also optimize water use internally. Today, mining companies are heavily investing in technologies to optimize and recirculate a significant percentage of water used. The more technology applied; the more water can be recirculated."

Water recirculation is not smooth sailing: "Water is necessary for many processes in mining, so its quality cannot be understated. The rate of reuse in the mining sector is high, but there is always water that is lost in this recirculation process. Miners must ensure that lost water complies with laws and standards to not bring problems to communities," emphasized Jerome Poujaud, business development director for Chile & Peru at Veolia.

Howden's water treatment system helps ensure water quality. Edson Luis Geraldini, the company's sales director explained: "It injects 80% oxygen into the water, significantly more than the 20% achieved with conventional methods. This technology can be particularly useful in northern Chile, where mines face water scarcity, by recycling the water used in mining production and allowing for its reuse in other areas."

Chile's multifaceted approach to addressing its water crisis—through legislative support, technological innovation, and strategic investments in desalination and recirculation—illustrates a comprehensive effort to ensure long-term water security and operational stability across sectors. ■



From Open Pit to Underground

By Esteban Hormazábal,
Managing Director – Chile
SRK CONSULTING

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High production rates should be understood not only as reaching a certain tonnage, but also achieving an adequate ore fragmentation.

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Open-pit mining is a low-cost mining method that allows for both a high degree of mechanization of its operations as well as handling large volumes of production. The method was initially designed to mine superficial mineral deposits with a wide range of ore grades, which could not be mined using underground methods. However, during the last decade, the depth of open pit mining has increased, and today it is possible to find pits operating at depths greater than 900 m, with plans to reach final pit depths of 1,000 to 1,200 m in the next 20 to 25 years. The fundamental economic factors in open pit mining, especially if it is deep, are related to slope stability and the efficiency and automation of waste and ore haulage (AHS, conveyor belts, transfer trolley systems among others). Depending on the ore grade and distribution, geometry and dimensions of the deposit, in some cases, underground mining by caving methods may be less costly than open pit mining operating at greater depths.

Today, there are many deposits that have a considerable vertical extension and, although their mining method is open pit, at a certain depth they will have to make very relevant decisions, such as continuing with deeper and deeper open pit mining, and the associated high costs for this type of operation, or changing to underground mining to reach the geological resources remaining below the final pit. Currently, there are several open pit mines that are planning or are in the process of transitioning to underground mining, such as Bingham Canyon, Resolution (USA), Chuquicamata (Chile), Grasberg (Indonesia), Palabora (South Africa), Oyu Tolgoi (Mongolia), among others.

In order to successfully develop a transition project from open pit to un-

derground mining using caving methods, it is essential to establish at least three key aspects from the geotechnical point of view: First, determining if the rock mass will cave, to then define the most appropriate mining method for the characteristics of the deposit, i.e., sublevel, block or panel caving. Secondly, the minimum area and shape required to initiate caving must be defined. Finally, caving mechanics and propagation must be evaluated to ensure that the connection of the cavity with the surface or the open pit floor will occur. All this requires fundamental decisions to be made to define a transition project: height of the mineralized column to be caved and associated to this, dimensions of the basal area (footprint), feasibility of a simultaneous operation of the pit and the underground mine, and the undercutting and extraction strategies, which will define the mining plan of the future underground mine.

A transition seeks to maintain production levels that allow continuing to take advantage of the open pit mine infrastructure, so any underground mining must be massive and incorporate methods such as sublevel, block or panel caving to achieve high production rates and low development, preparation and operating costs.

High production rates should be understood not only as reaching a certain tonnage, but also achieving an adequate ore fragmentation, which allows a continuous gravitational flow, and a minimum interruption to the unit operation of ore extraction from the extraction level.

Meanwhile, low cost should be understood not only as a low cost per tonne produced, but also an optimized mine design that allows a maximum height of ore column, the minimum necessary initial development, and a mining strategy that allows a safe and reliable operation.

The essential concept in mining by block or panel caving is to take advantage of gravity by undercutting the base of the ore column to induce caving of that column. Therefore, the first geomechanical consideration must be to evaluate whether the rock mass to be mined will cave naturally, or whether pre-conditioning of the column of ore will be required. Hydraulic fracturing boreholes and destress blasting (DDE) are the common techniques applied for this activity. Current practice for caving propagation is usually based on empirical correlations between the geotechnical quality of the rock mass, expressed in terms of Laubscher's MRMR index, and the hydraulic radius of the caved area, HR. However, this correlation must be used with caution and, preferably, as a basis for the development of a correlation adjusted to the local conditions at each mine. These analyses can be combined with complex 3D continuum and discontinuum numerical models to simulate macro-sequences, front caving performance, connection to surface, abutment stress concentration and potential risks of rockbursts. Additionally, these models can provide a preliminary assessment for the collapse potential and verify the support defined. ■

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Due diligence



Juan Castaño

CEO
AMPHOS 21 CHILE

Is there a project you would like to highlight?

Recently, we signed the largest contract in our history in Chile with BHP, a three-year, multi-million-dollar project. We are working with Enami on identifying lithium reserves in the mountains, and with Codelco and Emsa on investigations in the Maricunga salt flat.

To what degree does planning have an impact on mining operations?

In engineering, our focus is on preventing and treating impacts. We identify water resources with numerical and hydrogeological models and predict the long-term behavior of mining installations and their water impact. This includes assessing leach piles and tailings dams over decades and determining necessary measures like hydraulic barriers and water channeling.

What technological innovations is Amphos 21 applying to optimize operations?

Drones have become very useful to determine the presence of surface water, soil moisture depth and detect contamination spots in specific local areas. They make tasks like topography faster, which used to be quite time consuming. We use an FRx gun, an infrared sensor that determines the approximate concentration of metals in soil samples. ■



Luis Arcos

Mining Leader
STANTEC CHILE

How did Stantec's Chilean division perform in 2023?

In 2023, Stantec's Chilean operations saw remarkable growth, with significant revenue increases and a strong operating income. Our longstanding partnerships with major mining firms such as Codelco, BHP, Antofagasta Minerals, Anglo American, and Teck have solidified our presence in the very competitive Chilean market.

What is Stantec's tailings expertise?

We specialize in unconventional tailings management—such as paste, co-disposal, filtered, or thickened tailings— which all aim to increase the density of tailings. This approach significantly reduces water usage in transportation and deposition, minimizes spatial and environmental impact, and contrasts with conventional methods where water within the tailings is lost. Thickened and filtered tailings are materials with a much lower moisture content. The water is efficiently recovered, collected, and then recycled back into operations, enhancing sustainability.

We provide independent review of all tailings' facility designs for Codelco, ensuring they meet the company's stringent quality and process objectives.

What are Stantec's goals?

Our goal is for our people to feel they are working in a company that is helping current and future generations live in a better world. ■



Daniel Caro

General Manager
BFS

Can you detail Bermad Fluid Solutions (BFS)'s recent evolution?

We have organized our solutions into four business areas which are Flow Control, Water Treatment & Reuse, Monitoring & Automation and Fire Protection. We are now able to provide more integrated solutions including EPC projects and even plants operation.

What is the current performance of the valve business line for BFS?

BFS has also extend their solution offering in valves with a focus on the very special demands of the Chilean mining industry. For instance, we have implemented efficient solutions for extreme water hammer control requirements managing corrosive fluids like sea water and very high pressures. Also, our valve business line is evolving towards more intelligent control and digitalization. There is a recognized need for greater data management and remote-control capabilities.

What are BFS's expansion strategies for the next two years?

Our goal is to consolidate a wide and comprehensive value proposition to the market and be recognized by our customers as their strategic and reliable partner on water management, providing everything from efficient fluid handling to water quality control. ■



Mario Lazo Emparanza

Regional Manager
KNIGHT PIÉSOLD

“ We want to deliver specialized services using advanced technologies, like AI, and to support them with specialized professionals. We are looking for organic growth which includes the training of new professionals. ”

Can you introduce Knight Piésold and the company's presence in Chile?

Our goal is to become a company specializing in geo-technical services and water management for the mining industry. Recently, we completed the ninth phase of the Talabre reservoir for Codelco's Northern District, which features a wall extending over 30 km. We began more than three years ago with conceptual engineering, followed by basic and detailed engineering, and today, we do QA services for construction.

What recent trends in the tailings space has Knight Piésold observed?

Tailings deposits of the past were garbage dumps where mining companies disposed of their waste, not just grinding product but also contaminated water and other things. This has changed over the years due to the environmental permits and the global standard which obliges tailings deposits to have safety standards. Companies have become more concerned about their corporate image, which has forced them to follow the global standard. Much of Knight Piésold's current work is aimed at helping the mining industry standardize its tailings deposits. Countries like Chile, the USA, Canada, Mexico, and some countries in Africa have long mining histories which require a lot of capital to standardize deposits under the global standard.

This demand has caused a high demand for specialists that simply do not exist. Existing specialists are being demanded at a high rate, which has made the standardization process of the tailing dams much slower. By working with universities, we are trying to create more professionals in this area.

What are the challenges facing the mining sector?

Among the most important are environmental and social sustainability, improving waste management, minimizing ecological impacts, and collaborating with local communities. Climate change is also a crucial issue, with the need to reduce emissions and adopt renewable energies.

The shortage of skilled labor, the volatility of metal prices, cybersecurity risks, and the need to maintain investor confidence add complexity to the situation. Finally, the circular economy, focused on recycling and reusing metals, emerges as a key approach to reducing waste.

At Knight Piésold, the biggest challenge in the mining industry is the lack of professionals, and part of this has changed how we determine what to do with senior professionals. It has become more difficult for these professionals to retire as they provide an invaluable mentoring experience for young people entering the industry being an important part in the virtuous cycle of on-the-job training.

How can the mining industry adapt to more intense climate events and contribute to global climate change mitigation efforts?

The changing climate has been considered in many of Chile's mining operations. The El Niño phenomenon, for example, has existed for centuries since it has to do with the heating of the water and currents. The difference today is that these processes are happening much more quickly. Before the climate would fluctuate between the El Niño and La Niña phenomenon every few years. Now, the climate alternates between these two phenomena twice in the same year. It is not that there are new events, but rather these events will be more intense. Rains will be more intense. The heat will be more intense. The industry must manage its design criteria to associate with this intensity.

Climate change started a while ago. The events that are happening now are a product of a bad industrialization. What we do today will not have immediate consequences, but consequences that will be felt in years to come. We need to put the umbrella down and confront the damage we have done. On a country-wide level, we must consider how to generate solutions that favor the normalization of the climate.

What is the company's strategic focus moving forward?

There are many options for companies in the current day. Many decide to maximize profit through size growth. However, this path can compromise quality and expertise. At Knight Piésold, we aim to be a company that is specialized rather than large. We want to deliver quality services to our clients. The company is made up of highly qualified professionals. We want to deliver specialized services using advanced technologies, like AI, and to support them with specialized professionals. We are looking for organic growth which includes the training of new professionals. ■



Andrés Rojas

Director of Automatization and Digitalization LATAM
ANDRITZ

What does ANDRITZ offer the mining industry?

We support the entire mining market including tailings treatment, with a principal focus on copper and lithium. We have more than 30 filtration equipment technologies. In LATAM, Chile is our service separation technology hub. We are also involved with the principal pumping contracts in desalinization plants in the Chilean mining industry.

We have an extensive portfolio for cleaning up waste ranging from the cleanup of particulate matter to more difficult pollutants like mercury and sulfur dioxide. In the Chilean mining sector, we focus on the cleanup of particulate matter. Our first contract was with Codelco in 2022; in 2023 we got contracts with SQM and others.

What differentiates Chile in the global mining sphere?

Chile is a frontrunner in terms of applying automatization and digitalization in the roadmap to an autonomous plant.

The challenges of an expensive workforce, costly energy, and remote mining operations position Chile as an exceptional incubator for technological advancements. ■



Jerome Poujaud

Business Development Director, Chile & Peru
VEOLIA

What tailings solutions does Veolia offer the Chilean mining sector?

Regarding mine tailings, Veolia is working on processes to extract the water, recirculate, treat and extract valuable elements from it. For example, in one of the projects developed in Chile, we sought a solution for the recovery of very low concentration soluble copper.

Is there a project you would like to highlight?

In Chile, we are currently treating water from a large tailings dam in operation where we remove contaminants. This plant processes the water from the tailings deposit and removes molybdenum, among others, from the effluent before discharging it into the environment. We now want to study the possibility of recovering and valorizing this chemical element.

Can you describe Veolia's GreenUp initiative and how it will apply to the mining sector?

GreenUp is Veolia's new strategic plan for the period 2024-2027, accelerating the implementation of concrete solutions and stimulating innovation to decontaminate, decarbonize and regenerate our resources. GreenUp focuses on three key strategic drivers: local energy and bioenergy, water technologies and new solutions, and hazardous waste treatment. ■



Juan Campos

General Manager
INGENALSE

What are the milestones achieved by Ingenalse during 2023 and early 2024?

Ingenalse has consolidated its position as a strategic provider for CODELCO, excelling in water treatment, sedimentation, and water recovery. Additionally, we have developed key engineering and operational improvement projects for clients such as Capstone Cooper and Anglo American.

How does Ingenalse contribute to improving efficiency in operations?

To optimize mineral recovery in flotation, we focus on the development of our own technology, such as the Ingenalse cell prototype.

Regarding the efficient use of water, we offer customized solutions to increase the efficiency of equipment such as clarifiers and thickeners.

How could Chile leverage tailings reprocessing to meet the growing demand for copper?

Mining liabilities, especially older ones, often have higher grades than currently exploited deposits. Furthermore, the comminution process, which consumes most of the energy in mineral processing, is already largely carried out in these tailings. Some companies have found innovative ways to utilize tailings to extract other minerals, such as iron. Tailings reprocessing in Chile can become an important strategy to meet the growing demand for copper. ■



Construction and Contractors

Chile's mines tunnel themselves into the country's mountains

As open-pit mines mature, the cost of waste removal increases, making the transition to underground operations, where higher-grade ore can be accessed with less overburden removal, more economically viable. The migration from open-pit to underground mining operations has taken the Chilean mining sphere by force. Following Chuquicamata's pioneering efforts, beginning underground operations in 2022, the trend has surfaced, and gone underground, everywhere. Major surface mining operations, such as Los Bronces Integrado, Collahuasi, Ministro Hales, and Escondida, are migrating and/or evaluating migration to underground mining. With these migrations, 40% of the total number of mining operations in Chile would be underground operations.

Such migrations have provided Chile's underground construction firms with an opportunity. "The future of mining in the underground sector looks promising. We anticipate a significant increase in underground projects, driven by environmental considerations and the need to address low-grade deposits," said Andrés Llona Tagle, administration and finance manager at Mas Errázuriz.

The benefits of underground mining operations are immense, said Juan Pablo Merello, general manager at Skava Consulting: "Economically speaking, underground mining

emerges as the most profitable option. Tunnels offer a superior solution with less environmental impact than surface alternatives, allowing surrounding areas to continue functioning during construction and operation."

The lower environmental impact is pronounced: "The volume of earth moved is typically about 10 to 20 times lower compared to open-pit mining," said Adolfo Sicilia, general manager at OSSA.

Underground mining, however, is not a new concept, emphasized José Miguel Galera, CEO at Systra Subterra: "It was prevalent at the end of the 19th and the first half of the 20th centuries before the shift to open-pit mining in the 1960s. We are returning to underground mining, equipped with advanced technological resources and knowledge that we did not have 50 years ago."

An example of the advanced technological resources includes the use of robots within operations. OSSA is testing intelligent mobile robots in underground environments. "The UNDERAIBOT project aims at the experimental development of a deployable kit for inspecting and exploring underground environments in construction - such as mining galleries, tunnels under construction, hydroelectric

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Caroline Vender

CEO
SIGDO KOPPERS INGENIERÍA
Y CONSTRUCCIÓN

What are the standout projects of Sigdo Koppers in Chile?

Last year, we consolidated several important projects, including Quebrada Blanca II (Teck Resources) phase 2 flotation area and port development. We also ventured into the development of a major mining hub with Codelco's Chuquicamata division. Additionally, we established a notable presence in the two largest wind farms in Latin America, which are being built in Chile: Colbun's Horizonte wind farm and Engie's Lomas de Taltal. These projects reflect the new strategy that we developed in 2023, which focuses on mining and clean renewable energy.

What trends have you seen in the demand for your services over the past year?

Recognizing our potential beyond engineering and construction, in 2023 we managed to consolidate a business line focused on maintenance for major mining clients. This transformation positions us as not just as service providers but also as value-adding partners. After project completion, we seamlessly transition to maintenance operations, offering comprehensive support to our clients.

Can you provide details on the EVA robot and how you are using it in your projects?

EVA is a robot developed by Boston Dynamics capable of conducting 3D surveys of project progress. Another advantage of this robot, is its ability to enter confined spaces and undertake repetitive tasks in hazardous environments.

Could you discuss Sigdo Koppers' strategy for gender inclusion?

Operationally, we have trained nearly 6,000 women, encompassing professionals, frontline leaders, supervisors, and direct labor. Notably, we have initiated female welding programs in Brazil and Chile, along with electrical training initiatives. Finally, I am very proud to have been chosen as the first female CEO in the company's more than 60-year history. As both the CEO of Sigdo Koppers and as national counselor in the Chilean Chamber of Construction, I see a transformation of culture at the national level, with Sigdo Koppers acting as a pioneer. ■

Can you introduce Fluor, its history in Chile, and the services provided to the mining industry?

We cover everything from pre-conceptual studies to project execution, including engineering, procurement, and construction services (EP, EPCM, EPC). We provide support services for permit preparation.

What were Fluor's achievements in 2023 and 2024?

We successfully completed the Quellaveco project, a significant achievement for us and Anglo American Peru, standing out as a benchmark for the mining industry in the next 20 years. We exceeded client expectations in terms of production and technology, becoming the first digital mine in Peru and possibly all of Latin America.

We made progress on a project in collaboration with Salfa Corp, and also Salares Norte by Gold Fields, which achieved its first gold in April.

Could you highlight a successful case where you provided support to a mining company?

We are currently immersed in a 28-month project with an investment of approximately US\$1.7 billion. This project encompasses everything from mineral storage to tailings disposal, standing out for its focus on unconventional grinding with HPGR mills, solidifying our leadership in this technology.

Over nearly three years, we have worked closely with our clients to develop a comprehensive plan ensuring compliance with construction deadlines and requirements, despite technical, market, and regional uncertainty. We are currently in an advanced phase of procurement and engineering, commencing field execution.

What are the most demanded services by Fluor's clients in Chile?

There is a strong emphasis on pre-feasibility studies, anticipating a significant increase in activity towards 2027-2028. With reduced regulatory and political uncertainty, clients are responding to the growing demand for copper by mobilizing to prepare. The focus is on ensuring certainty regarding CapEx and program execution within the stipulated timeframe, requiring meticulous planning from the early stages. Clients seek both certainty and flexibility in their projects, valuing companies' ability to address all aspects of the project. ■

Jaime Álvarez

General Manager,
South America
FLUOR



“

Currently our Chile team has over 6,000 people, out of 21,000 people for Techint Engineering and Construction globally, and this shows the current strength of Chile's operations.

”

Claudio Perillo

President Andean Region
TECHINT

Could you provide a brief background of Techint's operations in Chile?

Techint was established in 1945 in Italy, and, after expanding into Argentina and Brazil, entered Chile in 1952 to do a project with Enap. Since the beginning, we were an EPC company, covering the full value chain of a project, from concept to feasibility, engineering, procurement, construction, commissioning, startup and we also have a division dedicated to operation and maintenance.

The period between 2022 and 2024 has seen our best years for Techint in Chile, thanks to our participation in two very large water projects, in Collahuasi and Codelco through Aguas Horizonte. At Collahuasi we are responsible for building a 194 km, 44-inch pipeline, with five pumping stations and other facilities all the way up to 4,800 meters above sea level. This project is essential part of Collahuasi's mine life extension for an extra 20 years.

At Codelco, with the SADDN project for the company's northern district, we have the full scope of the project: intake pipeline, desalination plant, 164 km, 48-inch pipeline, all pump stations, power lines and electrical substations and terminal reservoir.

At Collahuasi we currently have 4,000 employees, while we have 1,500 at Codelco; however, we anticipate reaching over 4,000 people there as well. Currently Chile has over 6,000 people, out of 21,000 people for Techint Engineering and Construction globally, and this shows the current strength of Chile's operations.

Water access regulation is pushing miners to desalination. What are the challenges to develop this technology in Chile?

The reverse osmosis technology is already proven, so from a technology standpoint, there are no challenges. The main issues come from the environmental perspective because permitting has been fairly complex. This said, there are already several desalination plants in operation, so the government is looking at desalination for water consumption for the wider population as well.

Techint employs approximately 200 women in your projects in the north. How does the company view female inclusion in the industry?

The construction industry has certain legacy issues that need to be addressed, such as slow technology adoption

and low gender diversity. The sector has never been very friendly to women. We need to create an environment that not only attracts and retains female workers, but also provides the relevant training for those women that want a new opportunity in a different industry and want to join the construction sector. It is not only a social matter, it makes complete business sense, as the industry often suffers from a shortage of people.

How do you manage safety when you have thousands of people in your projects?

Safety has always been one of our core values and key differentiators. Our approach to safety was significantly strengthened when we integrated our management system 20 years ago. Today, we are very proud to have a recordable incident rate below big mining companies in Chile, and way below the overall construction industry average. Having reached this performance is a big milestone, because people turnover is very high in construction. Beyond systems, the main aspect is cultural change; at the workers level we need to be attentive in the smallest details. At the middle management level, we need to work on discipline and planning the safety, and at top management level in active and preventive leadership. To have a good soft skills abilities today is a very important safety tool.

What are the main goals for Techint over the coming years?

We want to be known as the top engineering and construction company for big projects in Latin America. At an industry level, we will see the company expand from the traditional mining, oil and gas and power, into a wider energy transition sector, that includes more than power generation. For instance, we are doing the engineering of a e-fuels plant for HIF Global in Punta Arenas. We will see more opportunities in e-fuels and green hydrogen projects.

Internally, we will continue working on our safety performance, culture and diversity, while we undertake initiatives to bring value to clients. We like to be involved from the early stages of projects, so these can be executed smoothly during construction mitigating problems, especially considering Chile's complex licensing process. ■

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galleries - and rescue and emergency situations - like fires - in conditions of low visibility and without connectivity using mobile robots capable of being equipped with artificial intelligence," Sicilia elaborated.

Robots have been used within the Chilean mining industry for many years. Sigdo Koppers Ingeniería y Construcción employs EVA, a robot developed by Boston Dynamics, for engineering tasks. "Capable of conducting 3D surveys of project progress, EVA represents a pioneering technology

in Chile. Another advantage of this robot is its ability to enter confined spaces and undertake repetitive tasks in hazardous environments. We are harnessing this potential through our Special Maneuvers Unit (UME)," said Caroline Vender, the firm's CEO.

TBMs as the future

One of the greatest recent advances within the tunneling circuit is the use of mechanized cutting. This has been supported using tunnel boring machines (TBMs), which were brought to

the mining industry from industrial tunnel construction settings, like the metro line construction. "The growing attention towards TBM technology suggests a shift towards mechanized excavation in the mining industry in the coming years," said Merello. "TBMs offer significant improvements in safety and construction speed."

They also improve productivity, said Fernando Vivanco, general manager at Master Drilling: "Mechanical cutting revolutionizes mining with its unique advantages over traditional drill and blast methods. It enables continuous mining operations, multi-tasking by excavating, mapping, and supporting tunnel walls simultaneously. This boosts productivity significantly, targeting around 200-300 meters of tunnel per month compared to 60-80 meters with traditional methods."

Given their primary use is for road infrastructure TBMs have present size and height limitations in the mining environment. "We are looking to develop technologies akin to TBMs but tailored specifically for mining applications, forming a significant focus area for the upcoming year," Vivanco continued.

The transition to underground operations also benefits ventilations companies. Such companies are innovating to create ducts that provide clients with the most benefit. DSI Underground has been successful: "DSI Ventilation stands out for manufacturing semi-rigid products of special plastic, which offer impact resistance and low friction, resulting in significant energy savings. Recently, we tested our locally produced Hardline™ duct in a mine in northern Chile, which reduced the time needed to improve air quality by 33%, simply by changing the type of duct," said Carlos Leigh, regional CEO LATAM at DSI Ventilation Systems.

The transition to underground mining is not merely a return to past practices but a forward-looking move, leveraging cutting-edge technology and improved knowledge to secure the future of mining in Chile. As the industry adapts to these changes, it exemplifies resilience and innovation, ensuring that mining remains a cornerstone of Chile's economy for years to come. ■



“ There is a renewed positive energy in Chile, and we are all optimistic about the future as these projects gain momentum. ”

Darrell White

Group Executive Americas
THIESS

How was 2023-2024 for Thies and what are recent projects at the firm?

2023 was a year of looking to the future. We maintained and matured our crucial partnership with Antofagasta Minerals in the Centinela district. Additionally, we expanded our presence with Glencore in Baar and had rental units at BHP. Despite the national uncertainty, we managed to sustain and grow our presence. There are now significant projects moving forward, and we are actively involved in conversations with potential clients about both brownfield and greenfield projects progressing through the approval phase. Chile presents tremendous opportunities for our services. There is a renewed positive energy in Chile, and we are all optimistic about the future as these projects gain momentum.

What are current challenges in the Chilean mining industry and how does Thies help overcome them?

In Chile's mining sector, deepening open-pit mines pose challenges with lower copper grades and higher costs. Yet, this scenario invites collaboration. We prioritize sharing insights with clients to maintain cost-effectiveness as mines go deeper. By collaborating, we explore solutions like OEM agreements and technology sharing to manage costs.

We conduct trials of new technology in our operations, gathering data to offer proven solutions to clients. While historically, trials occurred in Australia, we are increasing local trials

involving clients directly. This hands-on approach allows them to witness benefits firsthand.

Technology, especially autonomy, is crucial for safety and efficiency. Leveraging our experience from Australia, we are introducing autonomy-ready fleets in Chile, starting trials this year to demonstrate value to clients.

What is Thies's approach to ESG?

We focus on workforce development to meet the mining industry's demands during the global energy transition. Our priority is to attract and retain talent by launching the Thies Institute, which will offer apprenticeships in maintenance and operations. Our goal is to increase female participation by 20% annually, acknowledging the value of diversity in improving maintenance and operations quality. The strategic rollout of the Thies Institute will benefit our company and help address similar challenges faced by our clients.

Our sustainability efforts include achieving net zero emissions by 2050. We are exploring solutions such as hydrogen and natural gas technologies. Initiatives like electric buses and transitioning to electric or hybrid vehicles by 2030 support our commitment. We prioritize community involvement and aim to support local businesses while creating jobs. As Chile progresses in addressing environmental impacts, we are working with clients to improve mine closure practices, ensuring sustainable outcomes and creating new opportunities.

What is Thies's process of innovation?

Our Innovation Technology Center in La Negra, Antofagasta, serves as a maintenance facility and a technology hub. We are strongly interested in expanding it into the Thies Institute for hands-on training. Regarding innovation adoption, clients like Antofagasta Minerals are open to new technologies and willing to serve as test beds. Collaboration and trust are vital; once one mine succeeds with technology, others often follow suit. It's about building trust and working together toward common sustainability goals.

Can you elaborate on the safety measures and strategies Thies implements?

Despite global challenges, we continuously evaluate our systems and processes to ensure they are robust and focused on minimizing risks. Our goal is for every worker to return home safely each day. We maintain a strong safety culture through visual and physical management, constantly reinforcing the importance of safety with our teams. We prioritize global learning by sharing incidents and best practices across our operations worldwide. Safety is a non-negotiable aspect of our business, and we are committed to doing everything possible to prevent accidents and protect our people.

What are the firm's goals and what are the plans for celebrating the 90th anniversary?

In the Americas, especially in Chile, we are strategically focused on minerals and metals due to their crucial role in global electrification. Our intentional growth here aims to showcase our capabilities and build strong customer relationships. Regarding our 90th anniversary, celebrations are taking place globally. In Chile, we will celebrate during Dia De Minero in August, a significant week to honor the value of mining and the contributions of our people. It is a moment of pride for our employees to be part of a company that has been shaping the global economy for nine decades. ■



Ailie MacAdam

President, Mining & Metals
BECHTEL

What is Bechtel's footprint in the mining industry?

Bechtel has built 40% of copper production facilities worldwide, with a large concentration of these in Chile and Peru. Our operations in Chile encompass various facets, from design and engineering to the execution of integrated EPC projects in the field.

Can you highlight a recent project in Chile's mining sector?

Our collaboration with Antofagasta Minerals spans decades, particularly in areas like Los Pelambres. In a recent integrated EPC endeavor, we undertook the design, procurement, and direct hiring of craft professionals. The scale was substantial, involving approximately 7,000 rotations of direct craft professionals. Our scope included the construction of a desalination plant, a 64 km water pipeline and the establishment of a new concentrator featuring SAG and Ball Mill. And as the project moved into operations during 2024, the customer has seen strong results, which have met and exceeded nameplate capacity at industry leading timeframes.

Our recent completion of the Quebrada Blanca Phase 2 Project (QB2)

underscores our commitment to meeting our customer's expectations even amidst challenges like COVID-19. This endeavor involved complex elements such as dual grinding circuits, extensive pipeline infrastructure, and substantial desalination and pumping systems.

How does Bechtel utilize technology to optimize mining projects?

We have productivity tools that integrate engineering, procurement, and construction, essential for managing projects through data. This involves understanding and planning for the materials needed, like pipe and concrete, and ensuring timely delivery to the construction site.

Our innovation center in Houston develops and runs these tools. We've successfully used them on projects like Los Pelambres. These tools help us design efficiently, procure materials effectively, and partner with the supply chain to reduce costs and stay on schedule.

What are Bechtel's goals and objectives in Chile for the next two years?

We are committed to advancing technological solutions to optimize project delivery, capital efficiency and mitigate environmental impacts. ■

What services does Mas Errázuriz offer in the mining sector?

Mas Errázuriz operates in three lines of business: underground works, civil works, and assembly and earthmoving. In the first line, they mainly include horizontal and vertical developments, and civil works and underground assemblies. For the civil works and assembly segment, they mainly serve related works for mining projects. In mining, the most demanded services are horizontal excavations or horizontal and vertical developments, construction of ramps, tunnels, caverns, shafts, chimneys, industrial plants, industrial assembly, and mineral extraction operations. What customers demand is safety and high construction standards, with a particular emphasis on meeting deadlines and quality of service.

What challenges does Chile face?

One challenge is to make the country attractive for long-term investment and to provide facilities for investors. Environmental and sectoral permits have a lot of room for improvement. Once an investment project is approved, the challenge is to have

enough skilled labor. We see that mining companies are increasing their production and require more specialized workforce. It is a major challenge to attract and retain this workforce.

What is your perspective on the future of mining operations?

We anticipate a significant increase in underground projects, driven by environmental considerations and the need to address low-grade deposits. Our focus will be on adopting technologies that enable more mechanized operations, reducing worker exposure and increasing productivity. We are committed to training specialized personnel in underground mining, civil works, and assemblies, which will help improve the efficiency and quality of our projects.

What are the company's goals and strategies for the future?

Our goal is to continue growing, not only in Chile but throughout Latin America, and to do so in a responsible, sustainable, and consistent manner. This involves not only governance aspects but also a commitment to our over 2,000 employees. ■



Andrés Llona Tagle

Administration and Finance
Manager
MAS ERRÁZURIZ



Fernando Vivanco

General Manager
MASTER DRILLING CHILE

Can you detail the technological advancements facilitated by recent acquisitions?

These acquisitions enable us to diversify our offerings, not just in South Africa but also in South America, including Chile. We are actively pursuing opportunities in Chile, focusing particularly on mechanical cutting. Unlike traditional methods such as drill and blast, mechanical cutting presents a more innovative approach to mining operations. We are exploring potential collaborations with companies like Codelco Chile División El Teniente.

What capabilities will the acquisition of AVA unlock?

AVA has a control fleet system designed for surface tracks, particularly for open-pit mines. AVA's value lies in optimizing control fleets to improve overall production efficiency.

While we are exploring opportunities with A&R, mainly on collision avoidance devices for underground mining equipment, our focus is on advancing mechanical cutting and horizontal development.

Can you elaborate on the competitive advantages of mechanical cutting?

It enables continuous mining operations, multitasking by excavating, mapping, and supporting tunnel walls simultaneously. This boosts productivity significantly, targeting around 200-300 m of tunnel per month compared to 60-80 m with traditional methods. ■



José Miguel Galera

CEO
SYSTRA SUBTERRA

What does Systra Subterra offer the mining industry?

Our key areas of focus include mine accesses and ramps for underground mining, water management, and transportation and ventilation infrastructures to support mining operations.

What tools has Systra Subterra developed to ensure projects are more sustainable?

At Systra Group, we have developed the Carbon Tracker. This tool assesses the carbon impact of our designs, whether using concrete, steel, or alternative materials, to create environmentally respectful designs with the smallest possible carbon footprint.

We also have Systra's Climate Plus application. This tool evaluates the impact of climate change on specific geographical locations by varying temperature parameters, wind speed, and other climatic indicators. It allows us to simulate and quantify these impacts, providing detailed insights during engineering to detect and minimize the carbon footprint of our projects. Climate Plus integrates advanced technologies to assess the lifecycle carbon emissions of infrastructure projects, from material extraction and production to construction, operation, and decommissioning. This robust method supports informed decision-making around low-carbon solutions and helps ensure our designs are resilient to climate impacts. ■



Juan Pablo Merello

General Manager
SKAVA CONSULTING

Which have been the most demanded services for your company in 2023 and so far in 2024?

During 2023 and early 2024, the demand for desalination services has been significant for Skava Consulting, especially with the boom of mining activities in northern Chile. We have focused on designing submarine tunnels for water intake and discharge in desalination projects, as well as working on associated distribution infrastructure. We are involved in four desalination projects with major clients among the mining industry in Chile.

Given the growing trend towards underground mining operations, this has led us to offer comprehensive consultancy to mitigate risks and optimize the execution of underground projects.

Do you consider that in the future the mining industry will lean towards the use of TBMs?

The trend towards mechanized excavation is clear, although its adoption is still limited due to machine restrictions, primarily designed for urban infrastructure tunnels. TBM technology needs improvements to adapt to mining needs. Access, ventilation, and conveyor tunnels, necessary in underground mines, could be candidates for TBM use due to their similarity to road infrastructure. ■



Carlos Leigh

Regional CEO – Latin America
DSI UNDERGROUND

How has the integration between DSI and Sandvik progressed?

We have been diligently working on integrating with Sandvik, who acquired DSI Underground in 2021. We are now part of Sandvik Mining and Rock Solutions, specifically the Ground Support division. Our integration has significantly expanded the range of products and services offered to the mining and construction industries. Sandvik Mining and Rock Solutions

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- Selective active support solutions

www.dsiunderground.cl [DSI Underground LATAM](#)

cover everything from drilling to production, and we complement this line with our anchoring systems. We are sharing technology and innovation to provide better service to our customers, with a common goal of ensuring safety underground and increasing productivity.

What new products are being launched in collaboration with Sandvik?

We are preparing to launch a new resin injection and bolting system globally, with DSI providing the resins and Sandvik handling the manufacturing of the machines. This innovation allows us to inject liquid resin instead of other cementitious alternatives, improving both productivity cycles and safety. We expect to launch this technology in Chile by the end of this year.

What is DSI's experience with virtual training?

Edvirt, a Swedish company specializing in virtual training, part of DSI, directly or through us, offer virtual training in a variety of techniques, from equipment use to the placement of materials such as resins and self-drilling bolts. Virtual training allows more flexibility and ensures constant and updated training for personnel, resulting in reduced equipment failure risks and increased safety at work.

Can you provide details of DSI's entry into the ventilation segment?

We decided to enter the ventilation market in a joint venture with ABC Technology Group, a world leader in this field. We established a partnership in Chile to expand to all Latin America and subsequently to Europe. We focus on two main areas: flexible and rigid ventilation ducts.

DSI Ventilation stands out for manufacturing semi-rigid products of special plastic, which offer impact resistance and low friction, resulting in significant energy savings. Recently, we tested our locally produced Hardline™ duct in a mine in northern Chile, which reduced the time needed to improve air quality by 33%, simply by changing the type of duct. Additionally, we have developed an innovative oval duct, our Twin Duct, which requires only one suspension system instead of two, simplifying its installation and reducing weight while maintaining the same air area.

How does DSI contribute to the circular economy?

We are pioneers in Chile in the certification of green steel, specially designed for mining and tunneling. We work with companies like AZA in certifying the use of green steel bars, and we have also key suppliers in hard roll coils, like Nippon Steel and ArcelorMittal who have traceable green production. The green steel process is known for its closed cycle: the steel used in mining is collected as scrap, returns to the mill, where it is transformed back into bolts, and other type of raw material, and finally, new systems are manufactured that return to the mine.

What are DSI's goals for the coming years?

We expect to finalize the integration with Sandvik. Additionally, we are focused on expanding into other business areas related to ground support. After being out of the civil market for many years, this year we have begun to reintegrate into civil projects, leveraging our engineering, products and service capabilities. We plan to consolidate these operations by 2025.

Digitalization and automation will also be fundamental aspects in the coming years. Currently, we have products that allow us to measure the behavior of the rock, enabling more informed decision-making in mining and tunnel projects. We recently launched xCell Cyclops™, a sensor that measures convergence to generate sensible and important data. ■



Nelson Batistucci and Francisco Caballero

NB: General Manager Power Technique Sudamérica

FC: Business Line Manager Power & Light Sudamérica
ATLAS COPCO

Can you provide a brief overview of Atlas Copco's presence in Chile?

NB: Initially, our offerings revolved around standard equipment like portable air compressors, drilling tools, bits & rods and, over the years, we have expanded our portfolio to include innovative solutions such as portable electric generators, lighting systems, pumping equipment, and sustainable solutions like energy storage systems and portable photovoltaic power plants.

How did Atlas Copco perform in 2023, and what trends have you observed in product demand?

FC: 2023 was a positive year for us with significant changes in product demand. Notably, the demand for our drilling equipment shifted to other sectors. We also saw new opportunities arising from Chile's adoption of new emission technologies in power generation, leading to the introduction of higher-quality products into the market. We also witnessed a surge in photovoltaic energy and energy storage, and Atlas Copco has significant innovations in this realm, such as portable batteries, solar illumination towers, and hybrid products, tailored to meet the evolving demands.

What are some standout products offered by Atlas Copco in the Chilean market?

FC: Energy storage units are very relevant to the Chilean market. They are essentially emission-free generators that can be portable, making them exceptionally innovative while eliminating fuel consumption, emissions, and reducing noise levels. The versatility of these units positions them as an excellent solution for meeting energy demands across various conditions.

Chile stands out as a market that readily embraces change and innovation, partly due to its regulatory environment.

How does Atlas Copco plan to celebrate the 70th anniversary and the firm's general plans?

NB: This year marks Atlas Copco's 70th anniversary in Chile, coinciding with the transition to a new global President & CEO, Vagner Rego, the first Latin American to hold this position in the Atlas Copco Group. ■



Edson Luis Geraldini and Rafael Ribeiro de Toledo

ELG: Sales Director
RT: Key Account Manager – LATAM
HOWDEN

What does Howden offer the mining sector?

RT: Our services span both underground mining and smelting operations. We supply ventilation equipment tailored for underground mining, including axial fans, while also providing centrifugal fans for foundries, blowers for acid plants, and water treatment solutions for mining operations. Our focus has expanded to include technology for carbon capture. We aim to deliver energy-efficient solutions, a cornerstone of Howden's legacy. We stand out in Chile through our equipment, which contributes significantly to energy savings and decarbonization efforts.

Can you provide insight into Howden's Ventsim software and its advantages?

ELG: Ventsim Control uses intelligent software connected to hardware devices to remotely monitor, control, and automate airflow, heating, and cooling to provide safer, more productive, and lower-cost ventilation to each mine. This solution can provide energy savings of up to 50-60% by accurately identifying optimization opportunities.

Our Ventsim Design solution is a complete software package for the comprehensive design of underground mine ventilation systems and tunnels by creating a precise simulation of the ventilation environment. It allows for a detailed understanding of ventilation conditions at every moment of the day.

What are Howden's recent innovations?

ELG: Howden's latest innovation is a water treatment system that can inject 80% oxygen into the water, significantly more than the 20% achieved with conventional methods. This technology allows for the rapid recovery of bodies of water such as lagoons and rivers. An example of its effectiveness is the Pinheiros River in Sao Paulo, which, after a 5-kilometer project with this technology, has seen the return of fish, turtles, birds, and the development of recreational areas like a popular floating bar. This technology can be particularly useful in northern Chile, where mines face water scarcity, by recycling the water used in mining production and allowing for its reuse in other areas. ■



Equipment and Technology

“

The mining industry's problem statement is to remove people from harm and to provide digital data-driven, sustainable solutions. This means we need to provide the infrastructure to do things differently than we ever have in the past.

”

John Swift
Managing Director Chile & Argentina
EPIROC

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Image courtesy of BHP

The Green Machine



Electrification and alternative fuels provide a sustainable future

Chile and Australia account for 70% of the current use of clean energy in mining, according to S&P Global Clean Energy Technology. Chile leads the way with 4,500 MW of current clean energy use, nearly three times the use of second place Australia. Mine electrification can slash energy costs by 40 to 70%. A fully electrified mine powered by renewable energy can reduce its carbon footprint by 60 to 80% compared to traditional operations according to McKinsey. As a key enabler of the net-zero economy, the mining sector will need to reduce emissions by at least 85% by 2050 to meet Paris Agreement targets. Nine of the top 10 publicly

listed mining companies have already set scope 1 and 2 net-zero goals for 2050.

In Chile, miners are marching towards electrification to realize lower emissions. Antofagasta Minerals plans to reduce scope 1 and 2 emissions by 50% by 2035 and to cut scope 3 emissions by 10% by 2030. Iván Arriagada the firm's CEO emphasized: "Replacing and reducing diesel consumption in our trucks by piloting a trolley-assist method using electricity, using autonomous trucks which are more efficient, and introducing automation at our mines are keys to the strategy."

Australian based BHP partnered with Caterpillar and Finning to replace its fleet with diesel-electric trucks, which will run under trolley operation. BHP expects to reduce haul truck emissions by around 30% with this solution.

The burden to lower emissions has been placed on original equipment manufacturers (OEMs), said Darko Louit, CEO of Komatsu Chile: "The primary focus for reducing emissions in mining operations are mining trucks, responsible for the generation of about two-thirds of the greenhouse gas emissions in conventional mining operations."

Electrifyingly Sustainable

OEMs are advancing rapidly in the application of electric solutions within the Chilean mining sphere, said John Swift, managing director Chile and Argentina at Epiroc: "Since 2022, when we commissioned our first electric loader at El Teniente, we have expanded to converting diesel machines into electric machines. If we are committed to sustainable productivity and transforming the mining industry, we must be committed to electrification. Three years ago, electrification was a concept; now it is materializing into viable products," Swift emphasized.

Electrification was the rationale behind Komatsu's creation of Power Agnostic Diesel Truck program, said Louit: "These trucks are designed to switch power sources throughout their operational life as new technologies become available, a feature built into their original design. This will facilitate adoption of the latest technologies without the need for renewing the whole vehicle."

Crane manufacturer Multiservice Grúas is also working towards more a sustainable product, said Felipe Fossatti, the commercial manager: "Our units now use a single engine instead of two, saving costs while maintaining mobil-



Felipe Fossatti
Commercial Director
MULTISERVICE
GRÚAS

“ Large-scale mining operations are internally developing and applying innovations like electromobility. Clear parameters for long-term development are essential. ”

ity. We are also exploring hybrid equipment with electric superstructures and combustion-powered truck bases.”

Electrification requires substantial investment in mine infrastructure to support increased electrical power needs. An open-pit iron ore mine that replaces its 27 diesel haul trucks and associated equipment with electric alternatives would more than double its electricity consumption, as reported by McKinsey & Company. The technology is not the bottleneck, said Ricardo Pachón, vice president sales Andean and Southern Cone at Sandvik: "The technology for electrification is ready. The main challenge lies in the scale of investment required for a full transition. A realistic and manageable goal is to aim for the complete replacement of the fleet with electric equipment within five years."

To solve issues with infrastructure, Chile is working collaboratively, said José Ignacio Urcelay, managing director at Scania Chile: "In terms of infrastructure in Chile for electromobility and autonomous vehicles, significant progress has been made in developing a collaborative ecosystem. Both the government and public/private entities are contributing, with investments made in gas and electromobility infrastructure, including a corridor connecting Puerto Montt and Antofagasta. In Santiago, investments have been made by both electric companies and vehicle manufacturers."

Infrastructure aside, attitudes are changing. "Managing change and fostering conviction is crucial. We need to proactively manage change to facilitate the transition to electric equipment and integrate innovation. This includes providing opportunities for the younger generation in mining, who has a strong foundation in technology," said Julio Piña Alegría, commercial director at XCMG.

Fueling the transition

Chilean OEMs are also looking to alternative fuel sources to reduce greenhouse gas emissions.

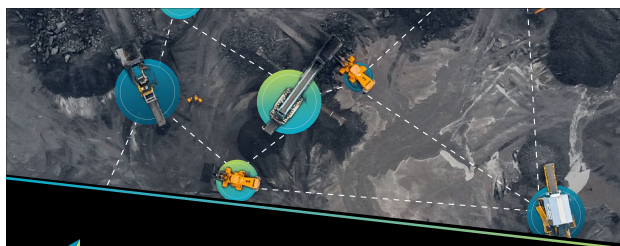
"Cummins has approved the entire line of diesel high horsepower engines, ranging from 19L to 95L, for use

with unblended paraffinic fuels (EN15940), commonly known as renewable diesel, including hydrotreated vegetable oil (HVO)," said Miguel Flores, the general manager. "This can lead to potential reductions of net greenhouse gas (GHG) of up to 90% compared to conventional diesel, depending on the specific feedstock and fuel pathway. All industrial engines are now capable of running on 100% renewable diesel or any blend of renewable and conventional diesel, without any modifications to the engine," Flores continued.

Hydrogen combustion engines are a viable path toward long-term, high-performing, sustainable, productive equipment, according to Leandro Farina, general manager, South America at JCB. "It is not a solution that will occur in the short term, however, in the medium term the infrastructure will likely be ready to receive these solutions. Latin America, and Chile particularly, is the region that is the closest to using this solution," said Farina.

Luckily, the appetite for new technologies is expanding: "In recent years, there has been significant progress in the adoption of new technologies in the Chilean mining sector, and there is still much potential to grow," said Christophe Boinelle, director of MC System.

In 2021, the Chilean government announced that all vehicles sold in Chile after 2035 will be electric, which includes mining equipment and trucks. OEMs will be the key to providing innovative solutions and adapting existing technologies to meet the industry's evolving needs. ■



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Darko Louit

CEO
KOMATSU LATIN AMERICA

What are 2023's highlights for Komatsu Latin America?

We have witnessed a record-breaking performance in terms of business volume in Latin America. I would like to highlight the commitment to deliver, during the next few years, up to 100 980E trucks to our customer Antamina in Peru.

Can you describe Komatsu's agreement with Codelco regarding project innovation?

In 2023 we continued to move forward with the project leading to the trial of a Tunnel Boring Machine (TBM) at the underground section of the Chuquicamata mine, which is slated to commence in 2025. Manufacturing of this machine has been completed recently and we will conduct the factory acceptance tests to verify the functionality of the TBM.

What is the state of autonomous fleet adoption in Chile?

There has been a significant increase in the number of mining sites adopting autonomous equipment. We expect this trend to continue in Chile with further growth of the autonomous truck fleets. We also see the introduction of autonomous equipment as a catalyst for a new demand of competencies both in maintenance and operational roles.

What social programs does Komatsu promote?

We work with the Reinventarse Foundation to offer employment to young law offenders, providing them concrete job opportunities, to re-invent themselves and be inserted back into society. This has been a very rewarding process that has literally changed the lives of many, both the young men and women that have gone through the program, and of our employees who have received them into our teams.

We actively promote technical careers among women in the heavy machinery maintenance sector, which historically has had relatively low female presence. In this sense, I would like to highlight an important milestone achieved in 2023, which is the first delivery of a 400-ton mining truck assembled by a team made up exclusively of women, to an important customer in Peru. ■

What were Epiroc's main highlights in 2023?

We inaugurated a new service center in Antofagasta and strengthened our digital support model throughout Chile. We have advanced our integrated solutions, making them much more defined in our new products.

We received our largest digital order in our history from Codelco. The partnership and order enable us to assist Codelco in achieving sustainable productivity. It strengthens a long-standing relationship between us and Codelco in the technology space. This order changes the focus towards helping Codelco advance toward the mine of the future.

What is Epiroc's growth strategy?

As Epiroc grows and acquires more companies, it grants us with more tools to solve a problem statement that encompasses the full value chain. To solve a problem—be it infrastructure, electrification, digitalization, or safety—we need tools. These tools come from the companies we acquire. Epiroc is always looking for inorganic growth. We are committed to accelerating the transformation.

How is electrification evolving in the industry?

From 2022, when we commissioned our first electric loader at El Teniente, we have expanded to converting diesel machines into electric machines. Electrical infrastructure poses a challenge to electrifying fleets. This challenge is the impetus behind some of our recent acquisitions.

What is Epiroc's approach to ESG?

On the environmental side, Epiroc in Chile was the first company to be certified for our tire recycling program. Socially, safety is at the core of what we do. We are committed not only to safety but safety leadership. Anyone in the company can be, and is, a safety leader. We are also increasing diversity. On the governance side, we do not participate in questionable contracts. If our communities do not believe we are ethical, we do not have the social license to operate and are just providing widgets. ■

John Swift

Managing Director Chile &
Argentina
EPIROC



José Ignacio Urcelay

Managing Director
SCANIA CHILE

Could you tell us about Scania's history in Chile and its main milestones in 2023 and 2024?

Scania has a strong presence in Chile with 16 branches covering the entire country, as well as over 16 service points at customer facilities. Over the past three years, we've maintained a 17% market share in heavy trucks, selling over 1,500 new trucks annually. In the mining segment, we lead with a 25% market share. Our success is attributed to milestones such as the launch of the Scania XT line for mining and the introduction of the latest generation of combustion engines, Scania Super, ensuring high operational availability. Additionally, last year, we introduced the new generation of Scania buses, offering safety enhancements, emissions reduction, and improved performance. These achievements have solidified our leadership position in the mining industry and positioned us as the second brand in the overall Chilean market.

What Scania products have driven demand in recent years and how do they contribute to sustainability?

The launch of the Scania Super truck, recognized with the 2024 Green Truck Award for its emissions reduction impact, exemplifies this commitment. Additionally, the Super and XT truck range is designed to enhance productivity and reduce operating costs, providing safety and reliability.

Can you mention the importance of Chile for Scania's market?

Despite being a competitive and relatively small market, it offers opportunities to test and develop business models globally. Additionally, Chile is key in the transition to electromobility and sustainability.

What are Scania's objectives and strategies in Chile?

Scania's objectives and strategies in Chile focus on investing in its human team, training in electrification, alternative fuels, and energy efficiency. We also plan to continue investing in infrastructure, especially in the northern part of the country. We aim to drive the transition to cleaner transportation by offering a wide range of customized solutions for each customer. ■

Can you discuss Sandvik's recent automation deal with Codelco?

Codelco is developing its largest automation project to date. This project, Andesita, is a part of a process to increase production at El Teniente. Sandvik will implement an advanced automation system and deliver an automated LH621i loader to Codelco's operations in 2024. We are currently in the implementation phase, and we expect the first stage of development to reach production level by the end of this year.

What is Sandvik's approach to automation?

To enhance productivity, Sandvik emphasizes automation, allowing machines to operate autonomously 24/7 without human intervention, increasing efficiency and safety. Despite the significant investment required, the long-term benefits include higher productivity at lower costs. Sandvik and its peers are innovating simpler, user-friendly technologies, paving the way for even a single operator to manage multiple machines remotely.

Chile is the global leader in automation. Codelco alone has around 40 machines running autonomously. The transition has not led to a reduction in workforce; instead, former manual operators are now managing machines in autonomous mode, working in safer conditions with amenities like air conditioning, food, and bathrooms. The role of personnel is evolving rather than diminishing, with a shift towards more analytical responsibilities.

What role do digital solutions play in Sandvik's automation strategy?

MySandvik and AutoMine are central to our automation strategy, primarily focusing on data analysis for enhanced decision-making in maintenance and productivity. By analyzing data, fleet managers can make informed decisions to optimize maintenance schedules and mining cycles. Our aim is to utilize such data to facilitate autonomous machine operation.

Can you discuss Sandvik's electrification efforts?

Sandvik recently launched the TH665B, Sandvik's largest battery electric mining truck in Australia. ■



Ricardo Pachón

Vice President Sales Area
Andean & South Cone
SANDVIK



Pablo Lam

General Manager
SK RENTAL

Can you describe the types of equipment in your fleet?

Our fleet primarily caters to the mining sector, representing around 65% of our business in the region. We offer a wide range of earthmoving equipment, from mini loaders to large-tonnage excavators.

What are some of the most notable mining projects you are working on in Chile?

We are currently involved in two major mining projects. The first is Collahuasi, which includes constructing a processing plant, pipeline installation, and a desalination facility. This comprehensive project is in full development and holds significant potential. The second is Centinela, an emerging project with a US\$4.4 billion investment, where we expect to be engaged for approximately two and a half to three years.

What are SK Rental's objectives for the coming years?

We see great potential in increasing leasing penetration in Chile, which currently stands at 30-35%, significantly lower than in markets like the USA (55%). Increasing this percentage is essential for the industry's future growth and our business sustainability. We aim to grow in tandem with the industry, navigating market expansions without negatively impacting other market players. ■



Leandro Farina

General Manager,
South America
JCB

How important is Chile for JCB globally?

Our distribution and support of the mining sector in Chile is large with a specific focus on Telehandlers for underground mining operations. We have a broad portfolio, offering the entire range of Excavators—including Mini excavators, and Wheel excavators —along with Telehandlers, Backhoe Loaders, Wheel Loaders, Skid steers, Compactions, and more.

What role does digitization play in JCB's operations?

We leverage a platform called Live-link, our equipment monitoring system. JCB manufacturers, distributors, and clients can use the platform to monitor the performance and geolocation of equipment. It also allows monitoring failure alerts, enabling all parties to partake in preventative maintenance to allow for continuity of operations and ensure all stoppages are planned. All equipment within the mining industry is equipped with this tool.

What are the company's future objectives?

In the region, our goal is to double the volume of equipment sales in the next five years. In Chile, we have a high market participation. We are a key player in the supply of Backhoe Loaders and Telehandlers. ■



Miguel Flores

General Manager,
CUMMINS CHILE

How is Cummins helping drive the decarbonization of the industry?

Cummins has approved the entire line of diesel high horsepower engines for use with unblended paraffinic fuels, commonly known as renewable diesel, with potential reductions of net greenhouse gas (GHG) of up to 90%, depending on the specific feedstock and fuel pathway.

We leverage electric technology in the automotive sector through acquisitions such as Meritor for electric powertrain solutions and Siemens Commercial Vehicles business. For mining, we are considering hybrid solutions, blending diesel with batteries, and exploring trolley solutions in collaboration with OEMs.

Towards the end of Destination Zero, Cummins' focus shifts towards hydrogen. We currently have five plants worldwide producing scaled-up electrolyzers for green hydrogen production, which we believe will drive business in the new era of sustainability.

What will drive Cummins' business?

Reducing our impact on the planet and assisting our customers and communities in the energy transition is key. We prioritize ESG considerations, mainly focusing on environmental initiatives like supporting water resources, preserving biodiversity, engaging in community volunteer activities, and promoting greater gender diversity within the mining industry. ■



Chile's Digital Revolution

Data, technology and automation are transforming the entire mine lifecycle

The global digital mining market was valued at US\$8.49 billion in 2023 and is projected to grow at a CAGR of 9.8% from 2024 to 2030, according to a Market Analysis report by Grand View Research. In Chile, the 2022 Digital Transformation Index found that mining suppliers achieved the most extensive digital transformation of any industry, landing 13 points above the national average for other industries. Benoît Richard, associate and director Chile at BBA, explained: "Chile will become a pioneer in digitalization, adopting technology, decarbonization and ESG guidance, not only because the country has the expertise, but also because it is necessary."

The necessity is simple, said TIMining co-founder and CEO, Nicolás Jubera: "In Chile, where we are exploiting copper with grades of 0.3%, inefficiency is not an option. In other places, the pressure is felt in the political sphere, while in Chile all the pressure is on production."

This pressure is multifold. Chile's existing operations have exploited the same deposits for decades. Codelco's Chuquibambilla, for example, has mined the same deposit for nearly 100 years. Furthermore, the world is demanding more of the minerals that Chile has in abundance, which increases pressure to not only locate the deposits but also exploit them quickly and efficiently. Yet exploration and production must be done responsibly. Globally, for the third year in a row, ESG is EY's top business risk and opportunity in the mining sector.

For Chile, a solution has presented itself, and the industry is capitalizing on it. Digitalization, the use of digital technologies and data, is being used to enhance every aspect of the mining operation, from exploration to production to processing. Digitalization is being used to improve performance and efficiency through automation, robotics, and integrated management systems, advance models with AI, increase safety, and reduce downtime, with real-time monitoring, predictive alert systems, and reactive detentions.

Exploring digitalization

In Chile, traditional exploration methods are being overtaken by digital tools, such as artificial intelligence and machine learning, to meet the urgent needs of the global energy transition, said Ignacio Torresi, executive vice president LATAM at Seequent: "It is fundamental for junior exploration companies wanting to enter Latin America to be disruptive and use techniques such as drones for faster/cheaper geophysical surveys, horizontal drilling, optimization of drilling, targeting core logging, geochemical survey solutions, and

continuous modeling. Those are options that will speed up the process of advancing an exploration portfolio pipeline."

According to S&P Global, for the 127 new mines that began operations worldwide from 2002 to 2023, the average time from discovery to commercial production was 15.7 years. For copper mining, exploration averages two to eight years and can cost from US\$500,000 to US\$15 million, according to the University of Arizona. On top of that, "With traditional methods, only 1 in 1,000 exploration projects become a mine," emphasized Amitai Axelrod, COO and co-founder at VerAI.

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YOKOGAWA ◆ Co-innovating tomorrow™

Yokogawa in the Mining Industry

Digital Transformation
Model Based Mining
Advanced Decision Support
Process Automation

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Ludwig Hecker

CEO
FERROSTAAL

“We worked in the locomotive maintenance program with Codelco and had no lost-time accidents for two decades. At 120,000 man hours annually, that is over 2 million man hours without accidents.”

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What was the evolution of Ferrostaal in the Chilean market?

Ferrostaal Chile, as a subsidiary of Ferrostaal in Germany, has operated in the country for 75 years. Over this period, it has been a fairly diversified company, as it has introduced technology and capital goods that are implemented together with clients in mining, oil and gas, and the general industry. We have participated in large facilities in mines for Codelco, BHP, and El Abra, including material handling facilities, as well as in pyrometallurgical facilities in Codelco and Enami smelters. Beyond being a key provider of technology, over the last years, we have increasingly offered long-term services in electrical and instrumentation areas, both for mining and oil and gas, including plant shut-downs, where we need to find and send the key personnel to the plant within very short time frames. With Codelco, at El Teniente, we have been providing electrical maintenance of their locomotives for 20 years, and we were also in charge of maintenance for the underground instrumentation and control systems at El Teniente.

We offer construction and installation services to the industry, and we have recordable incident rates much lower than the industry average. Safety has become a competitive advantage for us in the market. From a service perspective, we are not mainstream – instead, we participate in market niches where we can add value to the clients. For the last three years, we have grown by 30%, both in sales and profitability, and we want to continue this route.

Can you elaborate on the safety performance of the company?

We worked for two decades in the locomotive maintenance program with Codelco and have not lost any time to accidents. Considering we provide around 120,000 man hours annually, that is over 2 million man hours without accidents.

Safety rests on several pillars. First, our collaborators need to be fully trained to implement the tasks they are assigned. Then, we need the right methodology and processes in place. Finally, we need to work very closely with our clients so we can plan projects very well, because good planning allows us to identify any associated risks in advance and act accordingly.

What are the company's initiatives in decarbonization?

Our motto is ‘Turning ideas into reality’. We are quite opportunistic in identifying the main trends in the market and providing solutions to meet these mega-trends. One is decarbonization. This includes the development of synthetic fuel plants, notably e-diesel for land transportation, but we are also looking into sustainable aviation fuel (SAF). Our shareholders have made an early investment into a company called Ineratec, which gives us access to innovative technology to modularly scale synthetic fuels production plans.

How positive is the outlook for technology in Chile?

The mining industry is experiencing a super cycle due to the energy transition and the demand for copper, and this cycle should last for a few years still. In this context, decarbonization levels will depend on the clients’ will to adopt these technologies. With Ineratec, actually we can produce diesel at US\$6-7 per liter, but that is still higher than the US\$1.50 that a liter of standard diesel costs. Decarbonization will need the support of the wider industry as well as potentially stronger regulation to. Chile is an extremely liberal economy, and that is a double-edged sword. On the negative side, the industry is not forced by regulation to walk the extra mile when it comes to decarbonization, but on the bright side, Chile is an attractive market to innovate and try new technologies and concepts.

What are the prospects for the coming years?

Our main goal is to consolidate as an expert company in decarbonization, both in terms of consultancy from technical, engineering, and economic perspectives and as a relevant partner during the execution of those projects where we act as a provider of technology as well as a contractor. Additionally, we are acting as an investor in specific areas where we can generate a positive impact for our shareholders. As part of this initiative, we expect to implement a 10-MW synthetic fuel plant in Chile, together with partners, and well as energy storage facilities (BESS) based on an Organic SolidFlow battery manufactured by CMBLu Germany. ■



Óscar San Román

General Manager
YOKOGAWA CHILE

“Our two-year goal is to move from automation to autonomy. This means that our algorithms should be able to run industrial plants without human intervention.”

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How did external factors impact operations at Yokogawa in Chile during 2023?

For Yokogawa, it was a relatively normal year in terms of operations; we achieved planned objectives and performance was steady. A mix of internal and external factors influenced this. In Chile, the year was marked by political uncertainty, including debates over constitutional reform, which led to political polarization impacting the mining sector, urging us to adopt a more cautious approach. Several projects were delayed for months and remain in limbo. We also faced inflation that began stabilizing in 2023 after a challenging start at 12%. Amid these conditions, though, Yokogawa managed to maintain its market position in sales and revenue with key clients.

How important is the Chilean mining sector for Yokogawa's global operations?

Chile proudly hosts the competency center that provides technical support and assistance to other Yokogawa subsidiaries worldwide. Our team includes executives and engineers familiar with mining processes. This makes Chile an ideal center for knowledge expansion. From Chile, we are acquiring knowledge of mining processes, which enables our headquarters to gain deeper insights and secure resources for ongoing development.

What is the philosophy underlying Yokogawa's operations?

The vision of our company is to enhance

the quality of human life. This vision is grounded in the understanding that improving communal, national, and individual well-being is inherently linked to environmental stewardship. Achieving this requires precise knowledge of our environmental impact—identifying, quantifying and understanding pollution sources. Yokogawa's extensive range of field instrumentation is designed to facilitate this understanding, enabling the accurate measurement of pollutants.

With this data, actions become clear. This is where Yokogawa's control systems come into play, allowing us to leverage the gathered information to optimize plant operations in a remote and automated way. This information can inform the process of management and execution to better administer resources. This approach enables not only preventive maintenance but also predictive maintenance, which is even more forward-looking. Yokogawa provides the tools necessary for implementing concrete actions that contribute to social well-being.

In today's world, where humanity is seeking solutions to environmental challenges, technology and companies like Yokogawa offer the answers. We are at the forefront of integrating artificial intelligence into our automatic control developments.

Can you provide an example where Yokogawa optimized operations?

We started working in the concentrator plant of a large mining company in Chile. We installed a distributed control

system to supervise and control many processes. Within this, we focused on the sag mill, which is the largest energy consumer. We developed an advanced control algorithm that predicts mill behavior, considering various inputs like the type of mineral, the amount of water added, and the amount of grinding media used. By adjusting these parameters, our automatic control system can regulate the mill's speed efficiently. Operating at optimal speeds reduces the consumption of water, grinding media, and, most importantly, energy. The algorithm must control dozens of variables and how they correlate in seconds. This task is impossible for a human being.

What environmental initiatives does Yokogawa have?

Yokogawa has an initiative called AG2023, a three-year initiative aimed at accelerating innovative practices to reduce our carbon footprint. We are actively transitioning to sustainable practices, such as adopting electric vehicle transport and replacing traditional lighting with LED bulbs. We are now focusing on reducing our carbon footprint and enhancing our social responsibility by extending these sustainable practices to the broader community in each region where we operate.

Our actions are not just about saving the Earth; they are about preserving human existence. The planet will recover from our abuses over centuries, but without significant change, humanity may not.

What are Yokogawa's goals for the next 2 years?

Our two-year goal, which is a short time frame for a company like Yokogawa, is to move from automation to autonomy. This means that our algorithms should be able to run industrial plants without human intervention. We have already completed a yearlong trial of this in a petrochemical plant in Japan. After autonomy, we aim to have remotely operated plants. This requires high-performing algorithms with AI, deep learning, and reinforced learning. Yokogawa aims to achieve a greater presence in the mining industry, to attract new talent, and to train and develop existing talent within the company. ■



Rodrigo Couto

President - LATAM
HEXAGON'S MINING DIVISION

“The future of mining hinges on the integration of data in an agnostic manner, underpinned by a robust, scalable network infrastructure.”

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How has the acquisition of HARD-LINE strengthened Hexagon's offerings?

Acquiring HARD-LINE has allowed us to offer teleoperated units to clients. In under three months, we deployed more than 10 teleoperated units in Brazil and five in Chile. The level of client acceptance is significant. Teleoperated solutions can be used on dozers, trucks and shovels in all areas of risk. This acquisition is a market differentiator, allowing us to combine teleoperated equipment with one of our safety solutions, Hexagon Collision Avoidance System (CAS). Now, in instances where risk is detected, we can stop operations remotely. With these solutions, Hexagon has significantly improved safety in many global mining operations.

How does Hexagon support the shift to autonomous mining fleets?

Hexagon is developing a solution that is completely agnostic to OEM or model. Operations will not need a new fleet of autonomous vehicles— we can retrofit the existing fleet. Retrofitting equipment not only aligns with Hexagon's ESG goals, but also saves on costs by utilizing existing assets. We are in the final stages of setting up two 777 trucks in a Latin American mine, and we will be showcasing our progress at the upcoming MINExpo International.

What role do network solutions play in autonomizing mining operations?

A crucial aspect of autonomy is net-

working. Mining corporations such as Codelco, AMSA, Vale, Glencore and others are facing challenges in identifying the most effective networking solutions to meet their specific operational needs. The correct network should be multi-banded and multi-functional. The ideal solution will not only include LTE, but a combination of different network solutions like Wi-Fi, LTE, and MESH.

A network must be scalable and have a proper design. Hexagon assembled an in-house team dedicated to crafting top-notch network designs for our clients.

How does Hexagon improve safety across the mining industry?

In LATAM, approximately 10,000 trucks currently use Hexagon Collision Avoidance Systems (CAS). This includes Codelco, AMSA, Glencore, Vale, and others. We collaborate with clients to develop a safety framework, or smart centers— real-time safety dashboards that monitor operational safety levels. The data obtained from these safety dashboards enables mines to take proactive measures and offers visibility into effective safety practices. Our process begins with KPI implementation, followed by the integration of smart centers, and culminates in deploying the EMESRT Level-9 system, offered by HARD-LINE or other OEMs. In high-risk scenarios, our system intervenes when driver action is absent.

How does Hexagon optimize productivity in mining operations?

Our fleet management system, Hexagon OP Pro, acts to optimise traffic, which automatically increases the productivity and effectiveness of operations. Our smart monitoring system delivers instant reports to mine managers, highlighting operational bottlenecks and issues for proactive management. Additionally, our Smart Center generates environmental impact reports, detailing CO2 emissions and fuel consumption metrics. OP Pro assesses road conditions by tracking tire vibrations, which we present to clients as a heat map. This enables them to pinpoint areas requiring repairs. We have a partnership with Uber and leverage their algorithm to assess road conditions in mines, tracking truck speeds across different segments to identify speeding or slow-driving behaviors. Our use of AI tools allows for intelligent and preventive data analysis.

Could you tell us about what Hexagon has to offer for underground mining?

Hexagon's solutions for underground mining encompass planning, operation, production and safety. With the acquisition of Minnovare, we now offer enhanced drilling efficiency with real-time guidance on drilling angles. Hexagon's Underground Mining Collision Avoidance System (UG CAS) enhances safety through specialized sensors and software, detecting both equipment and personnel. We also offer Hexagon MinePlan Underground Engineering, which leverages 3D CAD tools for detailed mine designs and integrates with Hexagon UG Pro for seamless operation and fleet management.

What is Hexagon's vision?

Hexagon's solutions generate a vast array of data. The journey towards autonomous operations encompasses more than just autonomy itself; it necessitates the prior automation and transformation of data. Our strategy includes significant investments in AI, cloud capabilities and enhanced reportability to refine data analysis. The objective is to deliver aggregated data rapidly and precisely for decision-making processes. The future of mining hinges on the integration of data in an agnostic manner, underpinned by a robust, scalable network infrastructure. ■



Jorge Abraham

Local Division Manager
ABB CHILE

“While mining operations stopped worldwide during the pandemic, this was not the case in Chile thanks to its resilience, adaptability and use of technology.”

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What milestones has ABB achieved in 2023?

In Chile, we moved to a new office in the Torre Costanera Center, the tallest tower in South America. Related to decarbonization, we sold the first ABB eMine™ Trolley system in Chile, which is expected to be operational in the second half of 2025. Although other technologies such as 100% battery-electric or hydrogen equipment are being explored, the available energy today is through eTrolley technology, where the vehicle is electrified through overhead cables like trains.

What synergies will ABB unlock through the acquisitions of Sevensense Robotics and Meshmind?

ABB has been very strong in automation, but these acquisitions have strengthened our area of digitalization and AI. Additionally, we are developing batteries. Customers now want not only autonomous trucks but also trucks that run on batteries, and not just any batteries but special ones that can operate at high altitudes and under certain levels of demand.

How does ABB's eMine Trolley system contribute to more sustainable operations?

By changing energy sources with the eMine Trolley system, i.e., replacing diesel with electricity, we can introduce electric power into truck engines, automatically reducing fossil

fuel consumption and CO2 emissions. The energy must come from renewable sources that do not pollute and are environmentally friendly.

When there is a positive gradient on the roads, comparing a diesel truck with a trolley, the 100% electric motor maintains its speed along the gradient, while the diesel does not. This allows for greater mineral processing in less time, contributing to the optimization of activities. If the gradient is negative, energy can be regenerated and sent back to the grid. Geographically, there is always savings due to the irregular nature of the terrain. The market requires green copper, so customers must invest in changing their energy matrix.

What is the role of data in mining operations?

High-quality sensors and instruments are necessary to perform efficient simulations in the production process and helps to make good decisions, thus helping to reduce costs, increase productivity, and improve safety. We must also ensure that the data is of good quality and accurately represented to the user.

With mathematical algorithms, it is possible to understand how a mine will behave. Additionally, everything is in the cloud and it is possible to work with different data from anywhere in the world. This also allows for autonomous operations, such as trucks that drive following an algorithm.

What implementation challenges will new technologies face in Chile?

The technological knowledge of operators is a fundamental pillar. It is crucial to prepare people from the beginning to adopt new technologies. For example, ABB, a leading technology company, offers all the tools for these operators to have a high level of performance and productivity. We have our ABB University, a prominent Training Center where courses are offered to both ABB workers and clients on our equipment, thus supporting operational excellence in each mining plant.

How will Industry 5.0 be applied to mining?

The focus is on people, not equipment. New technologies require new operators. They need technologies that are easy to use. We need to create solutions and technologies that attract new generations to take advantage of their talent and draw them to mining. One can have cutting-edge technology, but if we do not focus on its users, we cannot implement them.

This new "wave" is now called "Industry 5.0". However, in the Chilean mining context, the national industry witnessed during the pandemic how technology could be used for mining activities. During the pandemic, while mining operations stopped worldwide, this was not the case in Chile thanks to its resilience and adaptability.

How does ABB plan to increase inclusion?

We have been awarded for two consecutive years in Work-Life Balance. We want to continue improving and creating an inclusive environment that recognizes the different needs of professionals at various stages of their development in the company. ABB, with nearly 70 years in Chile, will continue to work on one of its fundamental pillars: people, focusing on promoting diversity and inclusion of everyone in the company, regardless of gender, age, ethnicity, sexual orientation, abilities, or any other dimension, to create safe, positive, and productive work environments. ■

New methods are necessary. “VerAI can shrink the traditional targeting window from three or four years to two months, while significantly cutting costs,” Axelrod continued.

Efficient capital use is crucial in exploration due to reduced liquidity, as evidenced by the TSX-Venture Exchange index, which has halved since early 2021 amid a three-year decline. “By leveraging AI, we offer the industry a way to de-risk exploration investments and improve the odds of success, benefiting not only juniors but also mining financiers and investors seeking more efficient and reliable methods for mineral discovery,” said Axelrod.

AI is also being used to better analyze exploration results at technology firm Veracio. “Data captured undergoes preparation for analysis by AI within our cloud system, followed by validation by Veracio’s geoscientists. This process ensures the delivery of results to our clients within 24 hours,” remarked Eduardo Molina, the firm’s commercial vice president LATAM. “Currently, AI is being used to assist in data analysis; in the future, it is expected to be able to collect and process information autonomously. This will require extensive learning and proper education by the industry. It will allow for faster and more accurate decision-making, as well as greater real-time knowledge of the mining deposit,” he continued.

The digitalization processes

Digitalization can significantly enhance the efficiency of ore extraction and comminution. In extraction, digitally based tools, like Minesense’s ShovelSense, are demonstrating results. “It resulted in metal production increases of 5% to 20%, averaging 12% across all installations,” said Jeff More, Minesense CEO. “By scanning each extracted bucket, Minesense’s datasets surpass traditional methods like blast hole sampling, offering information down to every 50 to 90 t in the pit,” he continued.

After extraction, Fourthane utilizes digital tools to identify conveyor faults, reducing unexpected stoppages. Fourthane general manager Alfredo Serrano explained: “We started services with X-ray equipment for inspecting conveyor belts with steel cords, enhancing our diagnostic capabilities. This modern technology now allows us to use X-ray filming equipment to examine the condition of steel cords through-

out the entire conveyor belt in about 20 minutes. This process may be displayed on a screen, enabling operators to identify the belt’s condition remotely.”

SAG mills, the most energy-intensive components in the mining industry, can be managed digitally to minimize energy use, said Óscar San Román, general manager at Yokogawa Chile: “We developed an advanced control algorithm that predicts mill behavior, considering various inputs like the type of mineral, the amount of water added, and the amount of grinding media used. By adjusting these parameters, our automatic control system can regulate the mill’s speed efficiently. Operating at optimal speeds reduces the consumption of water, grinding media, and, most importantly, energy. The algorithm must control dozens of variables, and how they correlate, in seconds. This task is impossible for a human being.”

Not even remotely an issue

Digitalization has paved the way to remotely run operations. The incorporation of technologies such as IoT devices, sensors, and automation systems into mining equipment enable real-time monitoring and control of machinery through robust network connections, allowing operators to manage and operate equipment from remote locations. “Remote integrated operation centers, used by companies like Teck, Anglo American and BHP, show how technology has gained ground in the mining industry. The implementation of autonomous operations, such as operating long-distance mining trucks from Santiago, demonstrates technological progress in mining,” said William Lilis, operations director South America at Wood.

The implementation of remote operating centers is becoming popular. Cloud-based supporting technologies increased from 75% in 2021 to 94% in 2022, predominantly utilizing information hosted in data centers according to the 2022 Digital Transformation Index. This enables continuous operation and accessibility from any physical location. “Today everything is in the cloud, and it is possible to work with different data from anywhere in the world. This also allows for autonomous operations, such as trucks that drive following an algorithm,” said Jorge Abraham, local division manager at ABB Chile.

This is changing the fundamental underpinnings of the mining industry,

said Juan Cariamo, founding partner and co-CEO at Vantaz: “Twenty years ago, supervisors were stationed at the mine, observing operations firsthand. Now, they are far away in Santiago, relying on cameras, communication systems, and screen data. This represents a radical shift in mine supervision and operation.”

Fewer than 30 out of 100 young Chileans express interest in working in the mining sector. Addressing the talent shortage will therefore require a multifaceted effort. Remote operations are one way to draw talent that was previously underrepresented, said David Alaluf, managing director SC Chile at Endress + Hauser: “Automated remote systems eliminate the need for physical presence, reducing associated risks and costs. It also opens industry work to people who previously had limited access, like women. Historically, the mining industry has seen minimal female presence due to societal expectations. Automation and remote operation remove these barriers, allowing work from home or any location without the need for physical strength that was once necessary.”

A part of the network

The digitalization of mining operations would not be possible without networks. Transmitting the data collected in the field and transporting it to be analyzed and utilized requires robust network infrastructure. “Without a network, a mining operation cannot run autonomous trucks or teleoperate,” said Rodrigo Couto, president LATAM at Hexagon’s Mining Division.

“The correct network”, Couto said, “should be multi-banded and multi-functional. The ideal solution will not only include LTE, but a combination of different network solutions like Wi-Fi, LTE, and MESH. Combining different network solutions leads to better coverage and performance.”

Using a mix of solutions and continuously adapting new ones is critical, said Alonso Quiñones, country manager at Torsa. “Standard technologies lose efficiency. GPS, for example, loses precision if there are thunderstorms or clouds... Our anti-collision system is not only based on current standard technologies like radiofrequency, GPS, and ultrawideband, but also LIDAR and AI sensors within the camera which validate, with our algorithm, how critical an event is.” ■



Jeff More

CEO
MINESENSE

How have Minesense’s offerings evolved?

Our focus lies in transforming raw data into actionable insights for mines, starting with ore body knowledge. Initially, our growth phase centered on optimizing mine operations, enhancing decision-making at the face of operations, determining what should be sent to the waste dump and what should be processed. Yet our Belt Sense product, first implemented at Copper Mountain mine in Canada, and recently contracted by Collahuasi, is deployed just before the concentration circuit. The value of our datasets extends beyond mine operations to upstream and downstream processes.

What is Minesense’s strategic advantage?

What sets us apart is our capability to measure directly at the face of the operation. This ability to gather data at the source allows us to connect ore body knowledge from the pit to the processing stages. Our goal is to optimize the entire value chain within the mine by bridging the gap between mining and processing stages.

What are your plans for expansion in Chile?

Chile offers favorable conditions for business operations. We anticipate revenue growth in this region, with Chile playing a central role. ■



Fabián Pizarro

Director of Corporate Affairs
and Sustainability
INNOVATIONS IN MINING

What is Innovation in Mining’s vision?

We focus on medium and small mining operations, which often lack the capital to incorporate advanced machinery. Our model enables these companies to use innovative equipment, helping the sector increase production rates. Large mining operations wouldn’t exist without the support of small and medium-sized ones. Technological innovations like ours are crucial for raising production rates across the sector.

What is Innovations in Mining’s added value?

Ore sorting recovers value from waste using sensors like cameras, 3D cameras, lasers, and x-ray scanners. We can characterize minerals in each rock at a rate of 1,000 particles per second and 200 tons per hour. This quick, selective process boosts profitability.

How can ore sorting help solve the impending copper shortage?

Depending on the mineral content of waste dumps, valuable minerals can be recovered. When mining companies work with direct minerals, some minerals fall below the cut-off grade for processing, leading to marginal grades. Instead of sending these to waste, we use software to incorporate them into the processing circuit, reducing waste and environmental impact. ■



Cristóbal Undurraga

CEO
CEIBO

Can you introduce Ceibo?

Our mission centers on exploring innovative solutions, particularly focusing on enhancing copper recovery and mitigating the community impact of dust from mining operations.

What is Ceibo’s method?

Our method involves crushing the ore and constructing a heap for operation. We then establish chemical and electrochemical conditions within the heap, specifically designed for leaching refractory ores, including chalcopyrite. This innovative approach alters traditional heap process conditions, enabling us to efficiently extract copper from chalcopyrite. By leveraging our technique, we can achieve significantly higher extraction rates of 70-75% copper, enhancing both the efficiency and the economic viability of copper recovery.

What are Ceibo’s plans?

Ceibo aims to innovate in copper production by initiating on-site trials this year, advancing our collaboration with global mining companies, particularly in the US, Chile, and Peru. Our 2025 goal is to produce copper cathodes on-site at a small scale through our technology. The key to achieving this is developing a robust project pipeline, attracting talent committed to cleaner mining, and securing investors to support us until we’re self-sustaining. ■



Ignacio Torresi

Executive VP - Latin America
SEEQUENT

“ Our aspiration is to be the number one technology provider for all data and modelling of the subsurface. ”

How was the year 2023 for Seequent operations in Latin America?

Seequent recently acquired Flow State Solutions—a company specializing in flow modeling and simulation solutions for the geothermal sector—underscoring our commitment to a diversified, cross-disciplinary approach.

How do you see the current scenario for junior exploration?

Unfortunately, inflation and interest rates are still high. Add to that the slowdown of some economies, most notoriously China and the oversupply of commodities like Ni, Fe and Li. Companies are having to adapt to higher costs, and raising capital for drilling is improving slowly. It is time to build resilience through this complex moment, trusting the outlook for mining will improve.

How can the junior exploration sector attract investment at this moment?

In 2023, there was a global reduction in the number of meters drilled. The rebound began in January; the financing and the number of meters drilled has already started to improve, especially for gold and critical minerals used for electrical components. Despite the local economic and political challenges in Latin America, it is a region of countries with strong mining regulations and attractive geological potential. As technology providers we offer solutions that are fundamental to reduce and control drilling and prospection

costs and impact. It is fundamental for junior exploration companies wanting to enter Latin America to be disruptive and use techniques such as drones for faster/cheaper geophysical surveys, horizontal drilling, optimization of drilling and targeting core logging and geochemical survey solutions, continuous modelling. Those are options that will speed up the process of advancing an exploration portfolio pipeline.

What are the recent advancements at Seequent?

While our focus remains on Leapfrog, our commitment to innovation continues. In 2023, we introduced Slope3D, a software designed for 3D geotechnical analysis, particularly suited for hard rock environments. We are currently releasing limited availability versions of select cloud applications intended for geological and resource modelling.

We are expanding into the data management space, transitioning towards becoming an ecosystem-centric technology provider. This evolution encompasses the provision of cloud-based applications and a single source to all geoscience data. Our goal is to assist companies to remove silos by eliminating data redundancy and enhancing efficiency for all data from subsurface.

What is the evolution of Seequent Evo (Evo)?

Evo emerged from our initiative to enhance Leapfrog by extending its ca-

pabilities to the cloud when desktop processing and storage limits were reached by increasingly larger models. This spurred the development of cloud-connected applications bringing new efficiencies like collaborative modelling, automatic notifications, better cyber security, and safe data storage.

Our current ambition is to fully transition to the cloud, ensuring all functionalities available on the desktop are cloud-based, offering a secure, controlled, and optimized environment. An example is Visible Geology, a free educational application designed for geology instruction, operating entirely in the cloud without desktop dependencies. Our goal is to develop cloud-native applications that are interoperable with those of our partners.

How did traditional subsurface data management lead to inefficiencies?

Traditionally, subsurface data was stored in different file formats, like excel spreadsheets or PDFs, or in separate systems or departments within a company, and these silos often do not communicate with each other effectively. As a result, information can become trapped in one area of the business, making it difficult for other parts of the organization to access or use it. This can lead to inefficiencies, as people may have to navigate through multiple disconnected systems to gather the comprehensive information they need for decision-making. This is the biggest impediment to automation in subsurface modelling for the mining industry. It is especially damaging in a time when mining companies need efficiency. The solution is to create a common platform for data to be gathered, visualized, and shared.

What are Seequent's goals for 2024?

We want to achieve our commercial goals in a sustainable way, meaning happy customers and happy workers. One of our strategic pillars in Latin America for 2024 is to keep diversifying to segments such as Civil, Environmental and Energy. In mining our aspiration to be the number one technology provider for all data and modelling of the subsurface. And better understanding of the subsurface means better business and a better world. ■



Eduardo Molina

Commercial Vice Present –
LATAM
VERACIO

Can you give some insight into Veracio's recently launched technological solutions?

TruProbe represents our downhill-focused solutions, catering to subsurface data acquisition. TruProbe serves as the central platform for integrating data from sensors, facilitating subsurface data extraction. Complementing this, TruProbe Align ensures precise probe positioning, minimizing manual placement errors. TruProbe Align interfaces with TruProbe, a cloud-based system for data processing and visualization.

Strata serves as the central hub for integrating data from our solutions. It aggregates data from TruScan (core scans), drill material (chips or core), and subsurface data acquisition sensors, presenting an integrated interface for users.

TruScan 2.0 incorporates hyperspectral sensors alongside existing technologies like XRF, enabling comprehensive geochemical, automated logging, structural geology, and mineralogy analysis within the Strata environment, delivering information with the same efficiency.

How do Veracio's solutions improve productivity and efficiency in the mining industry?

By providing detailed mineralogical and geochemical composition insights, they empower precise resource management. Another key advantage of these solutions is their ability to detect harmful elements in the mineral deposit. By identifying these elements early, mining companies can take preventive measures to treat them and separate them from the material of interest. This not only improves the efficiency of the production process but also reduces environmental impact by avoiding the extraction of unwanted materials.

What are Veracio's key projects in Chile?

The Sierra Gorda project is a significant milestone for Veracio in Latin America, being our first project on a productive scale in the region. The project began in December 2023 with deposit calibration in our Santiago office. This calibration phase was followed by a field verification phase in which we scanned between 300 and 500 m of core samples from the deposit using TruScan, to ensure data consistency. Veracio continues to support Sierra Gorda's geoscience team by integrating scanned data into daily workflows, facilitating informed decision-making. ■

What does TIMining offer the mining industry?

We offer the opportunity to increase mine plan compliance and thus ensure that the value of the mine project is realized for investors and stakeholders. We do this by enabling our customers to understand when there are deviations to plan, and we help them make improved corrective decisions.

Our product suite aims to address three major challenges in the geotechnical and operational space: improving productivity, increasing efficiency, and ensuring safety in operations. Based on these concerns, we have developed a portfolio of products that range from optimizing the drilling and blasting process with DRILLIT, enhancing reconciliation and compliance of the spatial Mining Plan with DELTA, improving slope construction with SICT, integrating all geotechnical monitoring information with ARIS, automatically detecting geotechnical instabilities with TANGRAM, ensuring efficiency in the loading and hauling process with ORCHESTRA, and enhancing real-time mine situational awareness with AWARE.

How does TIMining help mining clients maximize efficiency?

We help reduce control intervals. Every mining operation has a long-term plan to maximize returns for investors. In mining, many current control intervals are a month-long, only allowing operations to adapt once a month. We manipulate and transform data in real-time to allow operations to realize and correct deviations. This reduces control intervals, allowing operations to increase productivity and operate more efficiently. We can do this in different areas including geotechnics, truck operation, and drilling, among others.

What are TIMining's goals in the context of the energy transition?

Today we operate in around 50 mines. We want to double that in the next two years. We are already present in most mines in Chile, so our goal is to grow internationally.

The energy transition will require copper and other minerals. Mining is the bottleneck. Digital technologies are going to ensure that these mines produce more and last longer. Chile is at the forefront of this change. ■



Nicolás Jubera

Co-founder & CEO
TIMINING



Comminution and Material Handling

A circular economy for exponential growth

A circular economy, which promotes restoring resources and decoupling economic growth from resource use, presents itself as an opportunity to move towards sustainability in the Chilean mining industry. A circular economy emphasizes maximizing value and minimizing waste generation throughout all stages of extraction and processing. It aims to preserve natural resources and extend the lifespan of extracted minerals and equipment, ensuring their value is sustained over time.

Chile's circularity is indebted, in part, to the nation's legal framework. The Chilean National Mining Policy 2050 cites a circular economy as a strategic objective to harmonize the

development of the industry with the needs of the environment. The policy specifically calls on mining suppliers to deliver products that can be recycled and reused. Additionally, Chile's Extended Producer Responsibility (EPR) Law, enacted in 2016, mandates producers to manage and finance the recovery or disposal of waste. "In the mining industry, there are processes of segregation and valorization of the main waste streams. There has been an acceleration of these practices due to the EPR law," remarked Jerome Poujaud, business development director for Chile and Peru at Veolia.

Use-life extension

Extending the use life of mining equipment and components is a critical strategy in advancing the principles of the circular economy as it enhances resource efficiency, reduces waste, drives economic benefits and minimizes environmental impact.

Hofmann Engineering, a company dedicated to the design, manufacture, and repair of equipment and components, has taken this concept head on. "Our commitment to product improvement involves customizing solutions for each customer to optimize equipment performance and longevity," said Jarrod Hofmann, general manager at Hofmann Engineering. "Our track record of delivering tangible results, such as doubling the service life of HPGR rollers, has instilled confidence in our customers," Hofmann continued.

Refurbishing equipment before disposal is essential to the principles of the circular economy. One such effort is Haver & Boecker Niagara's rebuild program. "While vibrating screens have coatings made of materials like rubber and polyurethane, their steel structure offers infinite recyclability. Our goal is to refurbish or reuse these steel components before resorting to steel recycling plants, which consume substantial energy," said Roberto Montiglio, managing director, Andean Region. "Not only does this reduce emissions but yields cost savings of 30-50% compared to new screens," he continued.

Delegating capital for new equipment may be a thing of the past, said Andrés Osorio, general manager at STM: "For clients to use a piece of equipment designed with certain characteristics for another job, or in the same job but with increased capacity, it is no longer necessary to remanufacture the equipment. Now we can reuse and enhance current equipment, which extends the use life of equipment and reduces waste."

A second life

"It is estimated that the mining industry recycles only around 7% to 9% of its industrial waste," lamented Edwin Vildósola, president of FLSmidth South America.

Efforts are being made to increase this percentage. "We are implementing a machine in our megaproject in Casablanca to separate steel from rubber, allowing us to valorize rubber and recover steel, which can be reused in our linings or used by foundries through agreements," said Vildósola.

In April 2024, Metso inaugurated a circular recycling solution at its factory in Concón for its Megaliner, Poly-Met, and rubber liners with the same goal: separation of different liner materials so that rubber and steel components can be recycled or reused in the manufacturing of new products. Eduardo Nilo, president, South America at the company emphasized: "This will be the world's largest and will allow us to recycle our mill linings completely, significantly reducing our carbon footprint. We have already initiated the testing phase and have recycled over 200 t of lining, and we plan to recycle close to 600 t/y over the next few years."

Recycling significantly reduces the need for raw materials. "We have initiatives to recycle the wear parts from our sizer, leading to lower raw material consumption in the long term," said Andrés Costa, managing director Chile and Peru at Takraf.

Lime manufacturer Cbb Cales uses more than 20,000 liters annually of alternative liquid fuel derived from residual oils from large-scale mining operations to operate its kilns in Antofagasta and Copiapó. This is not the only circular economy initiative the company is implementing, said Ulises Poirrier, general manager at CBB Cales: "We are exploring carbon capture, an emerging technology that would allow us to capture CO2 from our pipes and transform it into reusable or marketable fuels."

Metal

In 2024, the copper industry will release 100 million t of carbon into the atmosphere across the whole value chain. This amount is dwarfed by emissions from steel production, totaling 1.6 billion t/y. Steel and copper, however, can be recycled infinitely. Equipment manufacturers have capitalized on this to bring new value, without new emissions.

Magotteaux's Scrap Buy Back program is reinforcing a circular economy for all industry players. "Used balls from our customers are melted down and remanufactured," said Enrique Vargas, country manager Chile and Peru. "More than 80% of our raw materials come from recycled products."

Cable manufacturing company Madeco by Nexans implements a copper recycling program. In 2023, the company recycled 295.3 t of copper. Recycled copper reduces water usage by 90% and energy consumption by five times. Camilo Elton, general manager, noted: "By recycling copper, we not only address potential shortages but also reduce our environmental impact."

Australian based Glencore Technology developed ISACYCLE, a plant in Spain, scheduled to start operations in June 2025. "ISACYCLE allows us to recirculate or recycle various disposable materials from computers, cell phones, and cars, extracting metals for reuse," said Christian Pastén Cortés, Latin America business development manager at the firm.

Pastén emphasized, however: "In Latin America, we are still behind in adopting this aspect of circular economy for mining, but the technology exists. It is just a matter of educating, promoting, and getting local investors familiar with it."

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Andrés Costa

Managing Director Chile & Peru
TAKRAF GROUP

What projects was TAKRAF Group involved in during 2023?

2023 was an exceptional year for TAKRAF Group. We were able to secure great new projects, but unfortunately, these were not in South America. The teams in Chile and Peru were active in 2023 in terms of Brownfield projects. In operations where we already have equipment, we worked on improvement and optimization projects.

We are about to complete the expansion of the world's most powerful conveyor belt system at Chuquicamata underground. In addition, we are also working with one of the largest copper mines in Peru, where we are supplying a new transport system.

What challenges did the Chuquicamata project pose, and how did TAKRAF overcome them?

Chuquicamata underground heralds a significant leap in mining and material handling technology. Our belt conveyor system, a key component of this project, not only set a new benchmark by being the most powerful of its kind worldwide, but also embodied innovation with the introduction of the ST10000 steel cord belt and advanced gearless drive technology from our drive partner, ABB. This system efficiently transports crushed copper ore from deep underground to the surface, spanning a 7 km tunnel that overcomes 1 km of vertical elevation, culminating in a 6 km overland journey to the distribution silo.

This project was a challenge due to its scale, the integration of cutting-

“ We are about to complete the expansion of the world's most powerful conveyor belt system at Chuquicamata underground. ”

edge technologies, and the technical hurdles encountered both during the implementation phase and ongoing operations. The collaboration between operators, suppliers, and our team was pivotal in overcoming these obstacles, fostering a robust communication network that ensured the project's success and operational continuity. The development and successful implementation of the ST 10000 steel cord belt, tailored specifically for this endeavor, represents a milestone, now available for any system. Our engagement with the belt's developers is also ongoing.

How will collaboration help the industry?

Collaboration is essential among all parties involved, including stakeholders, clients, and even competitors. While direct technology development with competitors is not feasible, open communication on various topics is. Collaboration is transversal.

What technologies is TAKRAF Group focusing on?

We are focused on further improving our equipment and solutions offering, particularly technologies such as our sizer. The sizer, a comminution technology, is a low profile, lightweight, and efficient piece of comminution equipment originating from the coal industry. Our goal is to extend this technology further, making it increasingly effective for hard rock mining applications. Additionally, our focus extends to monitoring and control, especially

considering complex fire incidents on some conveyor belts. To improve system oversight, we have strengthened our collaborations with providers of monitoring systems, aiming for superior control and safety measures.

Digital twins offer significant potential for mimicking the operation of our equipment and enabling performance simulations under a range of conditions.

What are the benefits of High-Pressure Grinding Rolls (HPGR)?

The HPGR is not a silver bullet, but where applicable is a tremendous addition in milling circuits. It has been proven and demonstrated to work effectively, saving a lot of energy and water. The fact that size reduction is achieved through compression rather than impact also benefits downstream processes.

What is your outlook on Dry Stack Tailings (DST)?

It holds vast potential, not only in mitigating risks, of which safety is paramount, but also in reducing spatial requirements. DST initially faced challenges such as developing filters large enough to accommodate production volumes. Despite these hurdles, the industry has made significant progress. Large-scale filters are now operational in Peru, with new implementations underway in Chile. TAKRAF, together with our respected DELKOR liquid/solid separation brand, is a one-stop DST solutions provider.

How does TAKRAF Group improve sustainability in operations?

We continue to focus on enhancing the gearless drive technology as an example of direct reduction in energy consumption. Also, our proprietary MAXGen mechanism for our BQR flotation cells not only improves metallurgical performance but also reduces specific power consumption. Further to our range of DELKOR dewatering solutions, we are furthering our DST solutions, which means increased safety and reduced water consumption. We have initiatives to recycle the wear parts from our sizer, leading to lower raw material consumption in the long term. All these initiatives are being undertaken concurrently and in conjunction with a policy to reduce our carbon footprint across our operations. ■



Philippe Hemmerdinger

CEO
TECNOLOGÍA EN
TRANSPORTE DE
MINERALES (TTM)

Can you introduce TTM?

The transport of minerals has always been in our DNA, with a primary focus on conveyor belts. We also provide the supporting elements for conveyor belts including rollers, pulleys, scrapers, and control elements like fault detection systems, scanners that inspect the status of the belt, and more. We also provide support and maintenance of the belts. We manufacture all the complementary components for conveyor belts in Santiago and Calama. From our focus in conveyor belts, we have evolved towards sustainability and dust mitigation. We have an important line of products which are canopies, or covers placed over the conveyor systems to prevent dust from escaping.

What is the importance of secondary mining?

Ore sorting is a large part of secondary mining. There is a lot of copper encapsulated in tailings dams, slags and waste heaps. There are more than 50 million t of copper available or almost 10 years of copper production in Chile, that today we consider an environmental liability. We can process, clean, and separate these materials and produce minerals, presenting us with a unique opportunity. ■



Andrés Osorio

General Manager
SISTEMAS DE
TRANSPORTE DE
MATERIALES (STM)

What was STM's focus in 2023?

2022 and 2023 were both good years for STM, and many companies within the material handling sector, as we are always involved in long-term projects. The focus has been on improving operations, a trend that the market has maintained for a long time and will persist due to copper prices and the lowering copper grade.

How does STM support sustainability in the mining industry?

Conveyor belts in themselves are a more sustainable method of transport than trucks. Another important contribution that the industry is making is reusing equipment. If a client wants to use a piece of equipment designed with certain characteristics for another job, or in the same job but with increased capacity, it is no longer necessary to remanufacture the equipment. Now we can reuse and enhance current equipment, which extends the use life of equipment and reduces waste.

What are STM's main goals?

We would like to strengthen the relationship with current clients and increasingly expand our client pool. ■



Jorge Soto

Country Manager
ASTEC INDUSTRIES

What is Astec's history in Chile and what milestones were reached in 2023 and 2024?

In Chile, Astec operates directly without distributors for our crushing, material handling, asphalt, and concrete lines, offering equipment sales, spare parts, and services. In November 2023, Astec Chile began operating directly, a significant milestone that allowed a greater focus on customer service and market penetration.

What are the challenges and opportunities that most affect Astec in Chile?

We face a significantly high copper price, which is positive, but production costs have also increased due to declining mineral grades and the need for desalination plants to use seawater. A challenge for Astec is to develop innovative products suitable for these new trends. Additionally, there is expected growth in underground copper production, presenting opportunities. Our BTI factory in Canada provides equipment such as rockbreakers and hammer systems for underground mining, currently used in Chile.

What are Astec's objectives in Chile and the region?

While we have distribution in several countries in the region, including Argentina, Peru, Colombia, Mexico, and Central America, we operate directly in Chile. ■



“

The mining sector is notably insular, limiting exposure to practices from other industries or even different mining sectors, such as coal or iron, which place a higher emphasis on efficiency.

”

Sergio Zamorano

CEO
FAM AMÉRICA LATINA

What are the benefits of tubular conveyor belts?

Tubular conveyors are a variation of conventional belts, but the key difference is their formation into a tube using rollers. This tubular structure offers advantages, including being sealed, which makes it environmentally friendly as it operates as a closed system. It also accommodates tighter horizontal and vertical curves compared to conventional belts, which usually require much larger radii. This allows for more direct routes, replacing multiple transfers with a single path, offering significant environmental and capital benefits.

Tubular conveyors can handle steeper inclines and have found a growing niche since their inception. Over the past 20 years, developments have allowed these systems to extend to tens of kilometers. They handle capacities of 5,500 tons per hour, not just for lightweight materials but also for heavy ones like iron ore. Their flexibility allows them to follow the terrain without extensive civil works, often the most costly aspect in mountainous areas. Their ability to navigate curves and steeper inclines without the need for extensive civil engineering shows significant growth potential. They also take up less space and reduce dust.

What is FAM's experience in the transport and disposal of tailings?

We have significant experience in tailings management and are currently engaged with various clients on large-scale projects. Our equipment is flexible, including low-pressure stacking systems to prevent sinking and facilitate rapid movement for applying thin layers.

We are heavily involved in transitioning from traditional tailings dams to dry stack tailings, which represent the future of tailings management. In Chile, the disposal of water is not viable due to its cost and scarcity, while in Brazil, the focus is on avoiding water disposal or dam construction due to past tragedies and the desire to prevent future incidents. We are collaborating with clients in a multidisciplinary effort involving civil engineers, process engineers, and stability experts to develop methods for rapidly and economically constructing larger volume dry stack tailings. The volumes we are dealing with in Chile are enormous, necessitating innovative approaches to tailings management.

How does FAM incorporate technological innovation into operations?

All our machines are equipped with a data logger, allowing

us to collect data and monitor remotely. A standard feature we aim to introduce to the mining sector is a hotline. This service, facilitated by access to data, enables clients to reach out at any time. A standby technician can access the system, diagnose issues, like sensor malfunctions, directly, and either dispatch our service team or provide instructions for issue resolution.

How does FAM use digital solutions to make operations more productive?

For conveyor belts, we are implementing an AI-based image recognition system, currently in testing and already operational at a pilot plant level. This allows for continuous monitoring, enhancing our operational efficiency and reliability.

We leverage technology, such as a virtual reality (VR) lens system to train personnel. This system enables inexperienced personnel to navigate on-site while an expert, connected through VR, guides them in real time. This setup allows for real-time oversight.

How does FAM make operations more sustainable?

Our focus on continuous handling with conveyor belts, especially tubular conveyors, significantly enhances energy efficiency. Our warehouse has transitioned to carbon neutrality through the installation of photovoltaic panels. In field operations, we replaced traditional lighting towers, which typically run on generators, with solar towers. These towers are silent, require no fuel, and significantly reduce environmental impact.

How is the mining industry's adoption of energy-efficient technologies?

The mining industry lags the real world by 20 years. Globally, there is vast experience in low-energy, optimized systems, yet this concept is still novel in mining. The challenges within our industry stem from conservatism and a lack of knowledge. The mining sector is notably insular, limiting exposure to practices from other industries or even different mining sectors, such as coal or iron, which place a higher emphasis on efficiency.

The focus of copper mining is predominantly on production, with less concern for energy efficiency to cut costs or reduce environmental impact. This reflects a broader issue within the South American mining industry, where the need for energy efficiency, crucial for minimizing environmental impact, has yet to be fully acknowledged and addressed. ■

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Recovery and renewal

According to estimates from the National Service of Geology and Mining, mining operations in Chile generated 13 billion t of tailings between 1905 and 2022. Secondary mining presents itself as an opportunity to both reduce waste and bring new value from what was previously deemed waste. "The importance of implementing technology is to not generate waste, to move from the circular economy as a concept to an actual process. For example, if a rock is scanned and found to contain no minerals, it can be returned to nature without added chemicals," explained Fabián Pizarro, director of corporate affairs and sustainability at Innovations in Mining, a technology firm that operates an ore sorting plant with a client in Tierra Amarilla.

Ore sorting increases the efficiency of mineral processing by pre-concentrating the ore before further processing steps, reducing energy, water, and rock waste. Ore sorting allows mining operations to take advantage of low-grade ore below cutoff grades of 0.3%, explained Philippe Hemmerdinger, CEO of TTM: "Ore sorting allows us to double

or triple the concentration of the material and recover 85-90% of the copper. We send more minerals to the plants, with a higher concentration of copper."

Natural resource preservation

Average ore grade in Chile decreased from 1.39% in 2005 to around 0.65% in 2019, according to EIA estimates. "This means we need to process more material, especially through regrinding, to produce commercially viable concentrates," said Pastén, which leads to increased energy and water consumption.

High-Pressure Grinding Rollers (HPGRs) overcome these constraints: "These solutions will be even more relevant given the increasing demands for reducing carbon footprint and the efficient use of resources such as water and energy. We are focused on implementing these technologies not only in Greenfield but also in Brownfield operations," said Martin Brenner Knoch, regional managing director LATAM at Weir.

"HPGR technology is increasingly prevalent in the sector, with most mining companies expected to migrate to

it. Not only is it suitable for hard ore processing, but it also reduces energy consumption by about 70%," said Jaime Álvarez, general manager, South America at Fluor.

Decreases in ore grade are changing the flotation circuit, said Cristóbal Undurraga, CEO at Ceibo. "The shift from easily processed, superficial ores to deeper, refractory ores presents significant processing challenges due to the complex nature of copper deposits like chalcopyrite, necessitating a move from leaching to concentration methods."

Ceibo's method repurposes idle SX-EW infrastructure, reinforcing circular economy principles, and alters traditional heap process conditions to extract copper from chalcopyrite. "Unlike conventional acid leaching methods, which after extracting 15-20% of the copper result in the ore being passivated, our technique can achieve significantly higher extraction rates of 70-75% copper," Undurraga continued.

The integration of circular economy principles signals a transformative shift towards resilient resource management, reducing environmental impact while driving economic growth. ■

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Roberto Montiglio

Executive VP - Latin America
Managing Director - Andean Region
HAYER & BOECKER NIAGARA

Can you provide an overview of Haver & Boecker Niagara (HBN)'s performance in 2023 and your expectations for 2024?

In 2023, Haver & Boecker Niagara experienced growth in the Andean Region, recovering and slightly surpassing pre-pandemic revenue levels. Although 2024 has started well, we expect moderate growth, mainly due to unfavorable macroeconomic conditions in our main markets, Chile and Peru. We anticipate a growth rate of 10-12% compared to the previous year.

What were Haver & Boecker Niagara's most significant projects in 2023?

In 2023, for the Andean Region we closed a three-year contract for the major refurbishment of vibrating screens for Chile's leading iron ore producer. During the third quarter of 2023, we completed the first refurbishment of a piece of equipment under this contract, and we are currently refurbishing three additional units at our workshop in Santiago.

Another major success in 2023 was the replacement of two large pieces of equipment serving the crushing operations at an underground mine operated by the world's leading copper producer.

Can you provide insights into the inauguration of your new subsidiary in Peru?

We have a lot of equipment operating in the Peruvian market, includ-

“ Our Niagara rebuild program was initiated to deliver cost savings. While vibrating screens have coatings made of rubber and polyurethane, their steel structure offers infinite recyclability. ”

ing some 40-year-old units at the old Cerro Verde plant. We took the step of establishing a subsidiary in Peru, and although the process was delayed by the pandemic, in January 2024, we managed to legally establish our company in Peru and set up a physical office and a service hub in Arequipa. This will allow us to be closer to Peruvian customers, to have critical spare parts stock, and to provide better after-sales service.

How does your Niagara rebuild program contribute to the circular economy?

Our Niagara rebuild program was initiated to deliver cost savings to our clients. It focused on reusing or repairing components in suitable conditions, only replacing those beyond repair. While vibrating screens have coatings made of materials like rubber and polyurethane, their steel structure offers infinite recyclability. Our goal is to refurbish or reuse these steel components before resorting to steel recycling plants, which consume substantial energy. Beyond yielding customer savings of 30-50% compared to new screens, this initiative facilitated our entry into the realm of circular economy, which is now essential for us, our clients, and the broader mining sector.

What are the origins of the Niagara T-Class vibrating screen and how does this technology improve efficiency and productivity?

This vibrating screen, renowned for its simple but efficient design, was recently updated by our subsidiary in Canada. The update included improvements and features used in other models of screens from our brand, such as the F-Class and XL-Class. However, the T-Class maintains its original sizes and weights, allowing our customers to upgrade their plants without the need for structural or civil work.

What are the benefits of Haver's Pulse Condition Monitoring (Pulse CM) technology for vibrating screens?

Pulse CM is equivalent to having a 24/7 service engineer in the plant, continuously monitoring vibrating screens. With Pulse CM, sensors installed on the equipment continually transmit data to the cloud. Our software then analyzes this information in real-time using advanced algorithms and a vast historical database. This not only provides insights into current operations but also allows a comprehensive understanding of the past and forecasts equipment performance for up to four weeks.

This predictive capability allows customers to schedule plant shutdowns for necessary repairs, avoiding financial losses and production disruptions due to unplanned shutdowns. Moreover, the algorithm automatically generates reports and alerts when a problem is detected.

What are Haver & Boecker Niagara's goals for the coming years?

Our objective in Chile is to consolidate our major refurbishment business model by conducting repairs for both existing clients and individual orders. Our objective is to establish two concurrent contracts to strengthen this business model within the country. Regarding the Andean region, we expect the Pulse CM system to be very successful. This powerful tool does not require much sales effort since customers understand its value when they see it. Our focus lies on our subsidiary in Peru and establishing a service hub in the southern region. We strive to provide high-quality and personalized after-sales support to customers and to mirror our achievements in Brazil and Chile. ■



Martin Brenner Knoch

Regional Managing Director
LATAM
WEIR

Can you comment on Weir's operations in the context of the current mining sphere?

2023 Weir was successful, despite challenges arising from market conditions and political and tax uncertainty that mainly affects our customers to decide when and where they will invest. Chile encounters challenges regarding competitiveness and permitting processes. Despite the enticing surge in copper prices, we do not anticipate an immediate surge in mining projects. In 2024, we are facing a landscape with few new projects, but with customers seeking to optimize production and profitability through efficiency in mineral processing. We position ourselves as a strategic partner by offering technologies that will allow mining operations to reduce energy consumption up to 40% in their grinding process through our improved ENDURON High-Pressure Grinding Rolls (HPGR), our WARMAN pumping solutions and our CAVEX-2 cyclones with higher ore and water recovery rates through the complete process up to the tailings deposition. Our focus on digitalization allows for better equipment monitoring, diagnosis and process optimization through digital twins developed by our recently acquired AI company Sential.

What facilities does Weir have outside Santiago?

We have service centers in Iquique, Calama, Antofagasta, Copiapo, Serena and Santiago where we are able to support our customers with field service specialists, equipment manufacturing and repair. This proximity to customers enables a quick response to their needs, making Weir possibly the only company with a service center in the area.

What is Weir's commitment to ESG?

At Weir, we have a dual approach to sustainability. On one hand, we focus on the ESG sustainability of our customers, providing technologies that contribute to reducing the carbon footprint and align with their long-term sustainability goals.

On the other hand, internally, we are committed to reducing our energy consumption and implementing sustainable practices in our operations. ■

Can you summarize Metso's performance throughout 2023 and early 2024?

2023 was a positive year for mining development in South America, where several ongoing projects were consolidated. However, our outlook for 2024 is even more optimistic, as several greenfield projects have been activated in countries like Chile, Peru, and Brazil, indicating a positive development cycle.

Last year, we inaugurated two plants in the region, and in April 2024, we will open a recycling and coating plant in Chile, which will be the world's largest and will allow us to recycle our mill linings completely, significantly reducing our carbon footprint. We have already initiated the testing phase and have recycled over 200 t of lining and we plan to recycle close to 600 t/y over the next few years. With this initiative, we not only reduce our carbon footprint, but we also help manage mining out-of-use wear parts, significantly helping them accomplish their environmental KPIs and promoting the circular economy within the Chilean mining.

What is Metso's approach to technological development?

The merger between Metso with Outotec a few years ago allowed us to combine the technologies of both companies. Integrating our Research and Development centers allowed us to create a comprehensive platform of leading technologies in each area. Today, we invest over EUR 100 million annually in R&D, with 99,7% of this expenditure focused on developing equipment that drives efficiency and sustainability at all stages of the mining process, from tailings filtration to improvements in crushers and mills. These technologies later become part of our Planet Positive equipment portfolio, with a focus on environmental sustainability.

In the case of Chile, we have the largest Performance Center of the three that Metso has in the world. It is a remote monitoring center for the prescriptive maintenance of concentrator plants. ■



“
Our Jameson concentrators can reduce emissions by 60%, which is highly beneficial for new greenfield projects or modifying brownfield projects.
”

Christian Pastén

Latin America Business Development Manager
GLENCORE TECHNOLOGY

How does Glencore Technology help mining clients optimize operations?

In Chile, Peru, and across Latin America, we are dealing with lower grade polymetallic ores. This means we need to process more material, especially through regrinding, to produce commercially viable concentrates. Copper concentrates that are considered marketable typically have a copper content of around 22-24%, depending on the contracts with the companies purchasing the copper ore concentrates. In the past, it was possible to achieve higher levels of 30-35%, but these days the grades have decreased. We now need to break down or disseminate the particles to be able to float and recover them effectively.

Glencore's technologies, specifically the Jameson Cell, have been instrumental in recovering fine and ultra-fine particles that conventional concentrators usually lose to tailings. At Collahuasi and Centinela, we can recover fine copper and molybdenum particles, improving the overall recovery rates. We are working on several projects to implement Jameson Cells and IsaMill to recover these particles, increase plant recoveries, and produce a final, marketable concentrate.

95% of the electrowinning facilities use Glencore Technology's permanent cathodes. We manufacture them in Calama. We are advancing with new permanent cathodes that are more energy efficient. We are applying these in two major greenfield projects in Chile and one in Argentina, reducing OpEx and CapEx by 40-50%.

How is the company helping the industry be more sustainable?

We are focused on globalizing new technological developments, particularly aimed at reducing CO2 emissions worldwide. We are aligned with the mining industry to help find better alternatives for reducing CO2 emissions. For example, our Jameson concentrators can reduce emissions by 60%, which is highly beneficial for new greenfield projects or modifying brownfield projects in mining.

How does Glencore Technology partake in the circular economy?

We developed our first ISACYCLE, part of our pyrometallurgy group. It is a project in Spain, the first furnace of its kind installed globally. This technology allows us to recirculate or recycle various disposable materials from com-

puters, cell phones, and cars, extracting metals for reuse. The plant is scheduled to start operations in June 2025.

What is the role of technology in overcoming the copper shortage?

By showing investors that CapEx costs are no longer as high, we are helping advance projects. Modern greenfield plants can now be built with 50% of the traditional CapEx. You will soon see these new technologies in Argentina and Peru, developed by Glencore Technology. Our goal is to create more greenfield projects to meet the growing copper demand. We understand that large deposits are scarce, so we focus on optimizing smaller deposits.

The return on investment for concentrators over 20 years is tough for investors. It's better to shorten this to about 10 years, allowing investors to see quicker returns.

How does Glencore Technology promote diversity?

Glencore is a company with 160,000 employees globally, operating in all regions, including Latin America, North America, Europe, Africa, Asia, and Australia. Inclusion is also a core value for Glencore Technology, embedded in our DNA. We focus on promoting professional development based on their skills. At Glencore Technology, you can see people from Asia interacting with those from Africa, Latin America, and North America. We are very open and inclusive in this regard. We often refer to this as a "soup", bringing together people from different places, mixing them in a workspace, and letting diverse ideas emerge. This blend of cultures and perspectives leads to very innovative and valuable ideas.

What are the company's goals?

Our future strategy is to keep establishing ourselves in Latin America as a provider of technological solutions for the mining industry. Our focus is on offering support, services, and technology development that aligns with market competencies. We aim to implement our technologies to maintain mining extractions and solve various mining issues at a lower cost.

In the next five years, we hope to expand across Latin America. We performed well in the past seven years and are already present in several Latin American countries. We are increasing our number of clients in Chile and Latin Americas as a whole. In Chile, where we currently have two technologies, we plan to introduce three or four more, establishing bases with major mining companies. ■



Edwin Vildósola

President
FLSMIDTH SOUTH AMERICA

How does FLSmidth optimize equipment in existing mining operations?

We have a team called PerformancelQ, which monitors FLSmidth's equipment connected to our online system, allowing us to identify performance gaps. Currently, more than 14 customers in Chile are connected to this expert system, allowing us to constantly monitor equipment operation and offer data-driven recommendations. This digitalization covers everything from mining to processing, and even flotation.

Can you elaborate on FLSmidth's recycling initiatives?

Currently, it is estimated that the mining industry recycles only around 7% to 9% of its industrial waste, compared to other industries that recycle up to 25% to 30%. There is significant room for improvement. For example, liners and truck tires, as well as other waste, can be reused as raw materials in foundries or other processes, avoiding the generation of more emissions. We are implementing a machine in our megaproject in Casablanca to separate steel from rubber, which is a significant challenge in the industry. This process allows us to valorize rubber and recover steel, which can be reused in our own linings or used by foundries through agreements. ■



Enrique Vargas

Country Manager
Chile and Peru
MAGOTTEAUX

Can you introduce Magotteaux?

We are experts in mining-related solutions. We are the only supplier to offer a full range of grinding media as well as ceramic grinding beads, ideal for dry grinding in mining among other applications. In addition, we also provide vertical mill mining castings, crusher wear parts and ball mill liners that are designed to protect outer mill shells from damage.

What are the benefits of High-Chrome media?

Magotteaux pioneered the use of high chromium alloys in grinding media as well as composite materials in the manufacturing of high added value products.

High-Chrome media is aimed at improving the throughput of the mill, at a lower cost. We are currently in advanced conversations with a client in Chile to develop some trial tests.

How will the partnership with the University of Chile benefit Magotteaux?

We are very optimistic that this alliance will allow the development of new technology, innovation activities, support in the training of human capital and provision of services and equipment for innovation projects in the mining sector. ■



Dolores Requena

General Manager
ERAL

Can you elaborate on your activities in the Chilean mining sector?

We have worked with the country's main mining companies, such as Codelco, Mantos Copper (Capstone), Escondida (BHP), Minera Valle Central, Enami, and several medium-sized mining companies in northern Chile. We carry out engineering, design, and supply of plant and equipment, and our service expertise spans process engineering, specialized consultancy, and auditing services for both our supplied equipment and third-party installations that need enhancements. Moreover, we conduct piloting activities using our laboratory and pilot equipment. We also offer after-sales services, including spare parts supply, backed by a permanent stock stored at our industrial plant in San Bernardo.

Can you provide some insight into the tailings treatment plant you developed?

We have developed a non-conventional tailings treatment plant by Hidro-Dewatering Screens. This circuit offers several advantages, such as paste thickeners and belt filters. It is more economical, and cleaner, with low energy consumption and maintenance and enables the recovery of a significantly larger volume of water. We currently have several units installed in Mantos Blancos (Capstone Cooper) and we are actively engaging with other mining facilities to implement this method. ■



“

We won two large tenders with key lithium players in Chile to build significant projects.

”

Rodrigo Morales

Technical Director
TECPROMIN

Can you outline TecProMin's most important milestones in the past year?

Over the past year, we consolidated our presence in the lithium industry with successful projects in Argentina and Chile, establishing ourselves as a leading supplier in Latin America. We won two large tenders with key lithium players in Chile to build significant projects. This has led our company to do some restructuring to provide better commercial, technical, and logistical support. We have also been seeking more partners for both manufacturing and support services, leading us to expand our operations beyond our borders and subcontract manufacturing in the Asia-Pacific region and elsewhere.

To successfully complete all these projects, we have had to hire more specialized personnel. Looking ahead, 2024 holds great promise, especially due to our geographical diversification plans.

How important is collaboration in the mining industry to address the sector's current challenges?

Collaboration among stakeholders in the mining sector is crucial to address current challenges. Both mining companies and service providers must be aligned to delineate common goals and navigate market dynamics. As a Chilean company, we need to stay updated with client requirements, adapting their technological guidelines to suit our national context, and increasing our specialization accordingly. To stay ahead of the curve, we continuously explore new technologies and innovate within our operations. When it comes to participat-

ing in tender processes, we prioritize technological capability over purely economic considerations. Given the international nature of our industry, we are constantly engaged in global competition, which requires us to maintain a high level of technological advancement.

What is the current geographical presence of the company, and what are your expansion plans?

We have completed projects on all continents, in countries such as Kazakhstan, Indonesia, Spain, Ireland, Australia, the USA, Mexico, and many more.

Currently, TecProMin is focused on consolidating and expanding its operations in key strategic markets, particularly in Peru and Mexico. These markets represent significant growth opportunities, and together with Chile, they serve as essential hubs for covering the entire Latin American region. We are also committed to global expansion, making sure we have a strong presence in every market we enter. We are analyzing opportunities in Brazil despite its trade restrictions, and we want to consolidate our presence in the USA, leveraging our foothold in the Mexican market.

How does TecProMin stand out in a highly competitive market?

In bidding for projects, we often find ourselves competing based on economic criteria, meaning that sometimes our solutions are not initially selected due to their price. However, when clients chose cheaper options that do not yield the desired services, they turn to us for reliable and quality services. This happens a lot with our

sampling services, which has made us a key player in Chile and Peru's main mineral ports.

Our sampling systems are used in 30-40% of the world's copper production, and we ensure that samples are representative and of high quality for our clients. Our systems undergo independent audits, guaranteeing the reliability and transparency of our operations.

What has been TecProMin's experience in the Argentine market?

Argentina has been a crucial market for us in the last two decades, despite political and economic challenges. We have been involved in most of the relevant mining projects in the country, and our focus on the lithium industry has grown enormously in the last 10-15 years. Argentina represents approximately 40-50% of one of our main lines of business related to reagent preparation.

What would you like to achieve in the coming years?

Our goal is to continue to be known in the market as a high-quality boutique firm with fair prices, and to maintain our human and technological edge. Competition in this field is fierce, so we will focus on technological improvement and quality service. We have invested heavily in after-sales and field services, which are now a significant part of our income. We are always busy quoting specific projects and adapting to the individual needs of each client. In terms of sampling systems, our efficiency will be essential to help producers maximize their profits in times of low commodities prices. ■



“

We will increase our capacity by 50% to reach 1.8 million tons to meet future demand. By the end of this decade, mining projects will shift from oxides to sulfides, thereby using more lime in their processes.

”

Ulises Poirrier

General Manager
CBB CALES

Can you summarize CBB Cales' history and its role in the Chilean mining sector?

CBB Cales, part of the CBB group, was established over 65 years ago in southern Chile, initially focusing on cement production using local blast furnace slag. In the 1990s, as mining investments increased and mining companies began outsourcing supplies, we adapted our Antofagasta plant to produce lime. Lime production was initially seasonal, alternating with cement due to fluctuating demand. We expanded our infrastructure, and today, we operate a large plant in Antofagasta with three kilns, another two kiln in Copiapó plant, and a smaller plant in Argentina that serves both the mining sector and other industries. We also import lime from our Argentinean plant to supply to our mining customers in central Chile.

What have been the company's main milestones in recent years?

Over five years ago, we established a development center in the region, capable of replicating flotation processes and other operations of our clients. This center is unique in our region due to the specialized knowledge and technology in lime usage for copper flotation.

In terms of infrastructure, we have expanded our storage capacities with warehouses in central Chile and soon we will start new warehouse in San Felipe, in addition to our existing facilities in Copiapó and Antofagasta. We are about to inaugurate a new warehouse with a capacity of 4,500 tons in Pozo Almonte, in Tarapacá region, to be close our customers in the northern part of the country.

How is the demand for lime evolving?

The mining industry has progressively become more aware of the need to optimize lime use to reduce carbon emissions and the use of other reagents. Our contracts with clients often involve auditing services and evaluation of lime efficiency at plants, which contributes to improving its performance in flotation processes. It is crucial to keep in mind that mining conditions are dynamic, with periodic changes in work fronts that require adjustments in the reagents used, including adjustments in pH or timing to properly adapt to the specific deposit.

What are the company's plans to increase lime production?

We plan to start the construction of a new kiln in Argentina in the second half of 2024, which will reach a total production over 220,000 t/y of lime annually. This kiln is expected to be operational by mid-2026, and it is intended to supply both the Chilean mining market and the lithium market in northern Argentina. The local limestone in Argentina is of very high quality, which allows us to produce high-quality lime, essential for processes that require low levels of impurities.

In Chile, we are in the process of obtaining environmental permits for the construction of a new plant. We hope to start construction in 2025 and have it operational by Q1 2027.

Through this expansion, we will increase our total capacity by 50% to reach 1.8 million tons. This is key to meeting the future demand of mining projects that, by the end of this decade, will shift from processing oxide minerals to sulfide, thereby increasing the use of lime in their processes.

What efforts is the company making to become more sustainable?

We have been improving the efficiency of our kilns for many years. We implemented vertical kilns, which are over 25% more efficient than the traditional horizontal kilns in Chile, significantly reducing our carbon footprint. We are replacing fossil fuels with gas. In the long term, we are exploring carbon capture, an emerging technology that would allow us to capture CO2 from our pipes and transform it into reusable or marketable fuels.

What is the company's commitment to safety?

We identified a risk in transport operations, especially in the process of loading and unloading lime. To mitigate this risk, we have established a scheduling system for trucks to reduce waiting times, and we have introduced an online test that assesses driver fatigue and drowsiness before allowing them to drive. This system, created in collaboration with our transport company, also includes random alcohol and drug tests. All our routes are georeferenced, allowing us to monitor speeds in real time and ensure transport safety. We also have safety personnel at each plant who supervise and assist in transport and unloading according to standardized processes. ■



Equipment Components

Serving Chile's circular economy

A circular economy aims to maximize value and minimize waste throughout all stages of extraction and processing. It emphasizes the preservation of natural resources by extending the lifespan of extracted minerals. This approach operates within a systemic framework that necessitates collaboration within the industry and with other market players, who can be engaged to capture and share value.

The circular economy has gained traction in the Latin American mining industry in recent years due to the industry's increased focus on environmental impact. "The top five priorities in the mining industry for the past five years have

all been related to sustainability," said Mauro Mezzano, founding partner and Co-CEO at Vantaz.

A circular economy enables mining companies to not only control the environmental and social impacts of their operations but also adopt measures to minimize negative effects. It encourages sharing best practices and reducing waste, thereby fostering more sustainable and responsible mining practices.

The concept has funneled down into the pipes within the mining industry. Pipe and valve manufacturer Valmet is finding new ways to repurpose components that would originally be considered waste. "We are exploring the re-use of filtering fabrics in mining once they reach the end of their useful life. Valmet is currently investigating methods to recycle these fabrics in Finland to produce value-added products," said Gonzalo Silva, regional manager flow control business line at the firm.

Another pipe and valve manufacturer, Fastpack, has been attempting to improve their waste generation. "In 2022, we achieved a 55% recovery rate of our waste, and we improved this figure to 65% in 2023, directly attributing this progress to our increased recycling efforts and commitment to the circular economy," said Pedro Urzua, general manager at Fastpack.

One of the greatest lost resources in the mining industry is energy. This is especially true for copper, said Sergio Zamorano, CEO of FAM: "The focus of copper mining is predominantly on production, with less concern for energy efficiency. This reflects a broader issue within the South American mining industry, where the need for energy efficiency, crucial for minimizing environmental impact, has yet to be fully acknowledged and addressed."

Finding ways to reduce and conserve energy will be one of the most significant advances for the circular economy in the Chilean mining industry. The problem, however, is well understood. Carlos Lahura, managing director, Andean region at bearing manufacturer SKF noted: "Approximately 20% of all energy generated worldwide is used to overcome friction in various industrial processes, primarily in rotating machinery. By reducing friction, our bearings enable substantial energy savings across industries, including mining, manufacturing and transportation."

SKF has integrated the circular economy into the fabric of its decisions, introducing Circular Service Contracts in 2024, to prolong the life of bearings and components through



Fernando Tobar
Regional Service Manager
ANDRITZ

“The challenges of an expensive workforce, costly energy, and remote mining operations position Chile as an exceptional incubator for technological advancements.”

maintenance and remanufacturing, using monitoring to predict failures and minimize new material use, waste, and energy consumption. "Our solutions have demonstrated energy efficiency improvements of up to 30%," said Lahura.

Mitigating friction will help to overcome energy inefficiency. ANDRITZ offers technologies to extend the use life of wearing parts and reduce service maintenance of mechanical components via application of very high-resistance coating materials, said Fernando Tobar, manager of equipment and services of solid/liquid separation LATAM: "This technology has a large number of applications in the mining industry, specially oriented to all parts and components subject to friction, abrasion or wear and tear. We work closely with mining trucks as they have hydraulic cylinders subject to continuous wear."

Andrés Rojas, director of automatization and digitalization LATAM, highlighted the role of Chile's circular economy within this: "ANDRITZ has three global workshops with the capability to extend the useful life of components: Chile, Germany, and India. Chile is a reference for the region in the application of this type of technology."

Recycling initiatives are being wheeled into the Chilean mining industry from all sides, Rafael Santo, country manager Chile, Peru and Bolivia at tire manufacturing giant Michelin, said: "By 2050, our goal is to manufacture tires that are 100% made from recycled or renewable materials. Our intermediate goal is to reach 40% by 2030, and we are currently at 28%."

The bottleneck, he says, is recycling carbon black, which constitutes between 20% and 25% of a tire and is derived from petroleum products, making it non-renewable. The other 80% of tires include natural rubber, which is renewable and has a sustainable cultivation chain, and synthetic rubber, which is moving towards sustainability through methods that use recycled PET bottles. The company is working in partnership with Bridgestone to develop a sustainable carbon black supply chain.

The shift towards a circular economy in the Chilean mining industry not only showcases innovative practices and sustainable development but also aligns with global efforts to combat climate change and promote resource efficiency. ■

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“ In Chile, we want to expand the availability of our stock and increase the flexibility in valve assemblies, as well as our service presence. ”

Gonzalo Silva

Regional Manager – Flow Control Business Line
VALMET

Could you provide an overview of Valmet's performance over the past year?

2023 was an exceptional year for Valmet, especially in the mining sector. Valmet experienced great commercial success across all its areas, but particularly excelled in flow control, with record sales of valves and pumps. This achievement can be attributed to our significant participation in mining projects, as well as a stronger presence in northern Chile since we recently opened a new service center.

Our success in the mining sector can be partly attributed to our involvement in desalination projects. These projects require durable equipment due to the nature of desalinated water, often containing elements that accelerate corrosion. Our clients require equipment capable of withstanding such corrosive environments and high-pressure conditions for water transport to mining sites. We develop durable equipment using specialized materials, customizing solutions to fit each process.

What is Valmet's approach to digitalization and the advantages of your Customer Portal?

The goal of our digitalization journey is to make Valmet's equipment information available to customers. Previously, this information was fragmented and often only available to technical personnel. Now, we have integrated all equipment and spare parts information into a single platform known as Valmet Customer Portal. Through this platform, customers can view their Valmet assets, identify necessary spare parts, request maintenance quotations, access service reports performed by Valmet, and track the historical performance of each asset.

For valves, we provide access to the installed base, allowing customers to view all valves in their plant, and detailed information about the model, components, and recommended spare parts. We also integrate additional tools that monitor the health status and tuning of control loops. This information is combined with valve diagnostic data to provide accurate recommendations on maintenance and control improvements. Our goal is to centralize all relevant information into a single platform for easy access by customers throughout the lifecycle of Valmet-supplied equipment.

What is Valmet's sustainability strategy?

We are driving research and development of more sustainable equipment, focusing on improving energy efficiency, avoiding leaks, and ensuring responsible use of materials by the client. Moreover, we engage in collaboration initiatives

with other companies for material recycling, such as exploring the reuse of filtering fabrics in mining once they reach the end of their useful life. Valmet is currently investigating methods to recycle these fabrics in Finland to produce value-added products. We believe that technology plays a crucial role in mitigating climate change and global warming, and that is why we invest resources annually in our R&D operations, allowing us to continually develop new solutions to improve our customers' performance.

Could you provide some insight into Valmet's new service center in Antofagasta?

In response to the growing need for direct support service operations in northern Chile and our increasingly regular participation in the mining industry, we decided to invest in a service center in Antofagasta in 2022. This center enables customers to repair their assets instead of simply replacing them. We are evaluating process improvements where customers previously had to periodically replace new equipment, depleting older assets. We are implementing new technologies to prolong process availability and reduce waste generated by equipment changes.

Valmet recently approved an investment to maintain stock and locally assemble valves. This will allow us to reduce delivery times, improve product availability, and provide our customers with faster and more effective attention.

Could you elaborate on Valmet's participation in Sibanye-Stillwater's Keliber lithium project?

Valmet provided a complete solution, including valves, pumps, and an integrated control system for the project. This allowed the client to obtain different key elements in the mineral processing from a single company, resulting in economies of scale. Valmet was selected for this project due to our track record in developing flow control solutions and our recognition in other industries for our control systems.

What are Valmet's goals for the next two years?

We aim to continue expanding our presence and consolidate ourselves as a significant player in the process industry market. Our goal is to establish ourselves as a key player in flow control for the mining industry and expand our business to areas where we are currently not present, such as control systems. In Chile, we want to expand the availability of our stock and increase the flexibility in valve assemblies, as well as our service presence. ■



José Luis Villalón

General Manager
HILTI CHILE

What is the benefit of modular construction?

Modular solutions enable companies to enhance productivity by enabling faster and safer assembly processes. We work in engineering, so modular solutions help us optimize our client's predefined solutions, which helps to reduce the amount of materials used, such as steel which makes these solutions lighter, and at the same time we help reduce the carbon footprint.

Can you describe the competitive advantage of Hilti's Nuron platform?

Nuron is a platform adhering to rigorous safety, productivity, and performance standards, offering users data-driven insights for informed decision-making. Traditionally, the industry offers batteries of varying sizes for different tools, resulting in confusion for users. We have consolidated a single platform where compatibility is assured. With the same battery, our customers can power light duty tools and heavy concrete cutting or demolition tools thus covering the entire range of tools and applications needed in a construction project.

What are Hilti's growth goals in context of Chile's current economic position?

In the next seven years, we want to double our business. We want to continue being leaders in innovation. ■



Pedro Urzua

General Manager
FASTPACK

What solutions does FastPack offer?

FastPack's solutions are centered around fluid transport, fluid control, fire protection systems, and asset integrity, ensuring the resilience and reliability of system components. Our portfolio supports this mission, but our true ambition lies in integrating these offerings to present comprehensive solutions.

What are FastPack's environmental efforts?

FastPack is dedicated to enhancing our environmental performance, focusing on recycling and the principles of the circular economy to manage our industrial and hazardous waste. In 2022, we achieved a 55% recovery rate of our waste, and we improved this figure to 65% in 2023.

How is FastPack responding to the evolving dynamics of Chile's mining sector?

It is not sufficient to merely open new mines; we must embrace advanced extraction techniques, including chloride leaching and bioprocessing, as seen in BHP's initiatives, and the comprehensive recycling of tailings.

What is FastPack's competitive advantage?

We produce spools and valves in our own factory, producing 100% Chilean products. ■



Camilo Elton

CEO
MADECO BY NEXANS

How does Madeco by Nexans serve the mining industry?

Firstly, we provide products and services for new mining projects, whether it be greenfield or brown-field expansions. We supply maintenance, repair, and operations (MRO) products necessary for the regular operations of mines. This includes heavy-duty cables essential for equipment such as shovels used in mining operations.

What is the importance of the recycling program for copper?

Our recycling program involves separating plastic from copper and reprocessing it to produce cables. This helps us reduce waste and minimize our environmental footprint, contributing to a more sustainable future.

What objectives does Madeco by Nexans have for the next two years in the mining sector?

Our primary objectives in the mining sector revolve around strengthening partnerships with our customers and fostering innovation. We aim to provide even more value to our customers by understanding their evolving needs and delivering innovative solutions. Sustainability remains a key focus area, and we are committed to meeting the challenges of the future while ensuring responsible and sustainable operations within the mining sector. ■



Jarrod Hofmann

General Manager
HOFMANN ENGINEERING

“ In South America, we are focused on synergizing operations between Chile and Peru. This involves sharing capabilities and resources across workshops to maximize efficiency. ”

Can you provide recent updates?

We commissioned a large machining center in Chile in January 2024. This floor borer is a four-axis CNC machine and 50-ton rotary table capacity and is a game changer for us in terms of capability. This capability is crucial for our mining clients in Chile, with a focus in the Antofagasta and nearby regions, as it allows for local refurbishment, manufacturing, and repair services, reducing downtime and transportation costs significantly. One key local customer we are working with is Sierra Gorda in Chile, providing support for their HPGR equipment and other refurbishment needs.

What is the importance of Chile for the company?

In South America, we are focused on synergizing operations between Chile and Peru. This involves sharing capabilities and resources across workshops to maximize efficiency. We are the largest non-OEM supplier and refurbishment company for HPGRs in the region, supported by our machining capabilities in Chile. This enables us to provide swift support to customers during breakdowns or short lead times, while offering product improved componentry at discounted prices compared with the OEM pricing level. We apply a similar approach to other operations like shovels and trucks, strategically distributing resources to optimize efficiency and enhance overall capabilities in the region.

How has the implementation of HPGR technology unfolded in the mining industry?

HPGR technology is gaining traction in the mining industry, particularly in copper mining operations. It offers energy efficiency and water-saving benefits. Our involvement primarily revolves around repair and maintenance services for HPGR equipment. We have seen a trend towards its adoption, especially in operations dealing with medium to high hardness ores.

What is product line focus for Hofmann Engineering?

We prioritize growth by focusing on product line expansion. This includes HPGR and crushing refurbishment, maintenance of rope shovels, hydraulic excavators, haul trucks and general industrial gearboxes. As we are specialised in haul truck final drive refurbishment at our other global sites we are also seeking to expand into this area in Chile.

How does Hofmann Engineering hire and upskill local workforces?

In Chile, our workforce is entirely Chilean, reflecting our commitment to community engagement and empowerment. We invest in extensive training, including sessions in Australia and visits to machine manufacturers, to ensure our employees have the skills needed for their roles. We promote cross-skilling and knowledge exchange through visits to other sites

like those in Peru. Our goal is to foster a culture of continuous learning and development.

Can you highlight ESG initiatives?

A significant milestone is our ISO certification, where we have extended our standards beyond quality (ISO 9001) to include health and safety (ISO 45001) and environmental management (ISO 14001) across all our sites globally. While finalizing emission reduction targets, we are actively addressing waste management and energy consumption. Through robust systems and procedures, we aim to optimize resource utilization and minimize waste generation.

Additionally, community inclusion is integral to our corporate values, and we are dedicated to fostering positive relationships with local communities. In Antofagasta, for instance, we empower our teams to engage with the community. We support initiatives like a local kindergarten through financial aid and volunteerism.

How is Hofmann Engineering integrating data into operations?

Our transition to a paperless operation is progressing with our investment in HofApps, our application suite. This centralized platform facilitates access to crucial documents, work instructions, and marketing materials, fostering collaboration across our organization. We are also using digital solutions to optimize operations, including time tracking and inventory management. Digital time sheets and tracking systems enable real-time data capture on employee activities and resource utilization. Our online store integrates with our application suite, offering customers improved visibility into products and stock availability. By leveraging data and digital technologies, we aim to enhance operational efficiency, improve decision-making, and deliver greater value to our customers.

How is Hofmann Engineering planning to celebrate its 55th anniversary?

We aim to participate in our team's celebrations remotely, acknowledging the dedication of our long-serving staff, some of whom have been with us for up to 50 years. ■



Business Insights on Innovation



David Alaluf, Managing Director Chile, ENDRESS + HAUSER

“Technology has advanced, offering new tools and methodologies that signify the end of one cycle and the beginning of another. Our clients need to understand that embracing these changes is not optional; failing to adapt will render them obsolete as the industry moves forward with new technologies.”



Alfredo Serrano, General Manager, FOURTHANE

“In Australia, there is a company that has developed a robot that can move along the belt with a scanner to detect faults. We are bringing a pilot to Chile this year. Remote inspection of conveyors increases safety and lessens human exposure to dust and contamination.”



Mario López, General Manager, VIALCORP

“Our base KPI for dust control is 85% across all sites where we operate. Thanks to the technology we have developed, we are reaching over 95% dust control and 90% water saving figures across all our operations; we exceed our own KPI's consistently.”



Rafael Santo, Country Manager - Chile, Peru & Bolivia, MICHELIN

“In partnership with Bridgestone, we are developing a sustainable carbon black supply chain with the goal of reusing this material for tire production. This initiative underscores our dedication to environmental management and innovation within the tire manufacturing industry.”



Carlos Lahura, Managing Director - Andean Region, SKF

“Developed in collaboration with Amazon Web Services (AWS), the SKF Axios sensor incorporates cutting-edge AI technology at an affordable cost to provide real-time alerts for potential equipment issues in large installations by using thousands of sensors.”



Services

“

Chile will receive around US\$ 65.71 billion in mining investments from 2023 to 2032, a US\$8 billion drop from the previous 10-year forecast. Productivity is also declining terribly, as can be seen in how Codelco arrested the GDP. Suppliers have a lot to bring to the table to solve these problems.

”

Dominique Viera
President
APRIMIN

GBR Series • CHILE MINING 2024

Image courtesy of Torq Resources

The Rock Doctor Will See You Now

Drilling, blasting, and laboratories use rock characteristics to maximize yields

The Chilean mining industry faces significant challenges related to the hardness, abrasiveness, and geological complexity of its mineral deposits. These challenges are becoming tougher as surface level economically viable ore has long been depleted. "As pit depth increases, challenges arise because the rocks are harder, and the ore grades are lower. In Chile, since the biggest mines are old, ore grade is decreasing rapidly," said Cristian Cifuentes, general manager Chile and Argentina at Orica.

Drilling and blasting companies must deal with these challenges head on. Understanding the characteristics of the rocks, however, is helping ensure optimal, efficient solu-

tions. "Rock study is crucial in the mining industry, as rock characteristics affect all processes, including crushing, one of the most energy-intensive and costly mining processes. Optimizing our understanding of rock properties can generate enormous savings in productivity and costs," said Trinidad Carmona, Co-CEO at Drillco.

Drillco is working with the Imperial College of London and institutions in France and Sweden to develop a model leveraging sensors and algorithms for rock fragmentation analysis. "By understanding the intricacies of rock breakage under various conditions, we expect this model to optimize mining processes to increase productivity and obtain more ore with less environmental impact," Carmona continued.

Many Chilean deposits comprise of rock types such as andesite and diorite, which range from 6-7 and 7 on the Mohs scale respectively, which is roughly equivalent to the hardness of a steel nail. These hard and abrasive rocks accelerate wear and tear on drilling equipment, leading to increased maintenance costs and frequent downtime. Drill component manufacturers are looking at ways to help equipment to overcome this challenge. Jean Paul Drogue, general manager at Mincon, said: "Customized steel tailored to different rock types and drilling conditions ensures longevity and reliability in diverse mining environments. Understanding the varied lithologies present in mining operations, Mincon develops products designed to adapt to different drilling methods and rock types."

Steel quality ensures these benefits, echoed Tomas Buttazzoni, general manager at Technosteel: "The quality of steel is paramount to the performance and durability of our products. Inconsistent steel quality can lead to manufacturing defects and product failures, resulting in costly downtime and rework."

"Changing drill bits can lead to downtime, thus diminishing client productivity", said Ignacio Bello Marambio, general manager at Diamantina Christensen. "We have developed various designs based on terrain conditions - including factors like fracturing, compactness, competency, and hardness, and also capacity of drill rigs used. These tailored designs enable us to offer products that optimize performance and efficiency across diverse drilling conditions."

An explosion of benefits

By understanding rock properties such as hardness, density, and the presence of natural fractures, the appropriate type and amount of explosives can be selected. This ensures that the energy from the explosives is effectively used, leading to better fragmentation, explained Jorge Blázquez Hernández,

regional manager at Maxam: "Our X-Energy solution allows us to adjust the energy of explosives based on rock characteristics. Through data collection and mathematical modeling, we determine the exact quantity of explosives required for fragmentation."

Effective energy distribution is crucial for maximizing productivity and minimizing costs associated with re-blasting and secondary handling. According to Cifuentes, there is no better way to optimize than through digital tools: "We introduced our new 4D technology, an advanced explosive product that enhances energy distribution... In parallel, our digital solution, Rhino, has been pivotal in improving rock mass recognition and optimizing our blasting designs for better client outcomes."

Chilean deposits are characterized by many faults and fractures, which demand precise blasting techniques to ensure effective resource extraction and minimize dilution of the ore. "Knowledge of the rock mass properties allows for the design of more effective blast patterns", said Pablo Wallach, vice president of technology, innovation and marketing at Enaex. "We developed a new version and tools of Enaex Bright, a platform that utilizes machine learning to predict bench hardness based on data from previous benches. This information allows for optimized blast designs, improving efficiency and reducing maintenance costs for crushers and sag mills."

Rocking the flotation circuit

The mineralogies characterizing Chile's mining sphere have impacts continuing up the value chain, said Gülden Ergün, mining sales manager at BASF: "In Chile, in general minerals are complex so the process of extraction is also intricate, and very time-consuming... We have solutions that increase the efficiency while reducing freshwater consumption and process time. Our flocculant Rheomax DR, an advanced polymer with high density, allows for water recovery up to 7% and reduces carbon emissions. For leaching, we have a product called LixTRA, a powerful reactive that increases copper recovery by 3-5%, while not impacting SX-EW processes as well as reducing the impact on the environment and costs."

Understanding the specific chemical properties of the ore helps in tailoring the beneficiation process to improve the purity and yield of the final product. "Every operation has unique particularities and necessities", said

Ricardo Capanema, global marketing and business development director at Syensqo.

Chemical compounds play a critical role in maximizing yields during flotation. "The flotation process lies at the core of mining operations; depending on the efficiency of the reactive chemical compounds used, you can have very large differences in yield, sometimes 30 to 50%" emphasized Daniel Araya, general manager, Pochteca Chile.

A customized approach is increasingly important as mining operations face more challenging ore bodies and stricter environmental regulations, necessitating precision in chemical applications to maintain profitability and sustainability. "We take geological samples from our client's mining operations, analyze them, and produce customized chemical compounds that are best suited for our client's specific mining needs. This approach allows us to create product that can maximize our client's mining yields, depending on the specific geology that they deal with," continued Araya.

Advances in data analytics and machine learning allow for predicting optimal chemical usage and process

adjustments to enhance efficiency and reduce waste. "Digitalization enables us to analyze historical data to understand how various mineralogies react to different chemicals, allowing us to identify the most effective formula for a specific operation's mineral," highlighted Capanema.

Declining ore grades have been observed across the industry. Antofagasta's copper output, for example, fell by 10.4% in 2022 due, in part, to lower ore grades. Average sulfide ore grade in Chilean copper mines decreased 27% from 2005-2016, according to Cochilco. There is also a depletion of oxidized resources, which will mean 66% lower production of SX-EW cathodes by 2027. This decline necessitates the processing of larger quantities of ore to extract the same amount of copper, leading to higher operational costs and energy consumption; "production costs have increased due to declining mineral grades," said Jorge Soto, country manager at Astec Industries.

Customized solutions from drilling and blasting firms and laboratories will be critical in addressing these challenges to improve efficiency and sustainability in mining operations. ■



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Christian Barra Llano

General Manager
ORBIT GARANT CHILE

Can you give a brief introduction to Orbit Garant Chile?

The origins of Orbit Garant Chile trace back to December 2015 when our parent company, Orbit Garant Drilling Inc., headquartered in Val d'Or (Québec), decided to acquire Captagua Ingeniería S.A. established in 1956 and initially specialized in water well construction for the agricultural sector. By 2007-2008, it had expanded its services to cater to the water well construction needs of large mining companies, as well as surface drilling operations.

In 2015, Orbit Garant Drilling Services secured a significant underground mining project with Anglo American. Recognizing the need for a well-established company capable of meeting the diverse requirements of the Chilean mining sector, as well as environmental, safety, health, and tax regulations, Orbit Garant acquired Captagua in December 2015. In August 2016, we rebranded ourselves as Orbit Garant Chile S.A.

With the Anglo American project, Orbit Garant embarked on its first underground venture, having primarily focused on surface drilling and water well construction until then. Since then, Orbit Garant Chile S.A. has continued to develop its expertise in underground projects.

What have been the main milestones and projects of Orbit Garant Chile in the last two years?

Between 2022 and 2023, we executed a short and long-hole drilling project with Exploraciones Mineras S.A., the

“ We achieved a significant milestone by drilling one of the deepest boreholes in the Chilean underground sector, reaching approximately 1,550 meters in depth. ”

exploration division of Codelco, utilizing up to five drills. We achieved a significant milestone by drilling one of the deepest boreholes in the Chilean underground sector, reaching approximately 1,550 meters in depth. The increase in inflation, exchange rate fluctuations, and high steel prices compelled us to enhance operational and technological efficiency to meet shareholder and corporate profitability targets.

Since 2016-2017, we have been working on the Los Bronces project with Anglo American. This project presents unique challenges, especially in the dewatering domain.

Our successful bid for a significant contract with Freeport-McMoRan via Minera El Abra has extended our collaboration for an additional three years. This contract encompasses surface drilling services, including both DDH and RC systems, along with horizontal drainage systems.

What value does Orbit Garant offer its customers in the competitive drilling market?

Our service portfolio includes water well construction, pumping well construction, and environmental well construction. Additionally, we offer reverse air technology for faster drilling and provide dust samples for geological analysis. We also perform drilling with diamond technology, allowing detailed subsurface analysis through core samples. We have the versatility to drill both horizontally and vertically, across varied terrains.

We also innovate in systems and applications; through the implementation of digital reporting and data analytics tools like Power BI, we identify operational bottlenecks and optimize working time.

What can private companies and the Chilean government do to attract investment?

The government must ensure the stability of rules and regulations in the medium and long term. Political and social stability is essential for investors to make informed decisions about their investments. Economic factors also influence investment decisions and project viability, such as new taxes, the tax structure, and incentives for hiring diverse personnel. It would also be beneficial to promote collaboration between mining companies to standardize operational and safety requirements, like in Canada. This would simplify accreditation processes and reduce costs, allowing a quicker start to new projects and greater efficiency in drilling services.

How important is the Chilean market for the Orbit Garant?

Orbit Garant began trading on the Toronto Stock Exchange in 2008, and 3 years later, it began expanding internationally. Currently, it operates in Guyana, Chile, and has some operations in Africa, representing approximately between 20% - 25% of corporate revenue, being Chile the most important branch. This geographical diversification helps stabilize corporate revenues, especially because the gold industry, predominant in Canada, and the copper industry, predominant in Chile, have different behaviors.

What are the company's objectives for the coming years?

We aim for continuous growth by offering comprehensive solutions to our customers. We stand out as a niche company, focused on maintaining close relationships with our customers rather than seeking the highest number of drills in operation. Our goal is to be collaborative partners, helping our clients achieve their objectives and overcome challenges in drilling and well maintenance. Additionally, we want to consolidate ourselves as a company and team where our employees can be satisfied and are motivated to solve problems together. ■



“ In Chile, technological innovation is a fundamental requirement in technical bids and a key differentiator among companies. ”

Alex Simón Jofré

General Manager
AKD INTERNATIONAL

Can you detail AKD International's history in Chile and the main milestones of 2023 and 2024?

AKD International started in Chile in 2012 at Minera Quadra, Sierra Gorda. Despite the copper downturn that year, we secured a contract with Yamana Gold in 2013 at Minera Merida in El Peñón, marking the beginning of continuous growth. Between 2013 and 2016, the company experienced significant expansion, surpassing 90,000 m/y of drilling and expanding contracts with Antofagasta Minerals, Rio Tinto, and others, reaching a peak of 160,000 m/y of drilling.

In 2022, following the loss of the El Peñón contract, the company faced restructuring. In 2023, assets were relocated to a more structured location, but reduced contracts with junior companies led to a decrease in drilling activity.

In 2024, our main objectives are cost control and recovering lost contracts. Fortunately, we secured the contract at El Peñón again, reaffirmed existing contracts, and established strategic partnerships with Pan American Silver and BHP. Additionally, we have been in negotiations for Brownfield projects, anticipating new opportunities in the market, especially in the realm of junior and Greenfield companies.

In Chile, is there an increasing prioritization of quality over costs in the market?

There is a growing maturity in the market that values quality over costs. We recognize that the initial investment may be higher, but in the long term, prioritizing quality proves more cost-effective. Safety is our top priority, understanding that the integrity of our employees is paramount. We maintain low accident rates and work daily to uphold these standards. Additionally, we invest in innovative technologies to enhance the execution of our drilling programs. Our focus on operational continuity is reflected in the longevity of our employees, with many surpassing nine years of service. Hiring under indefinite contracts ensures security and experience within our team.

What technological innovations and services does AKD International offer?

In Chile technological innovation is a fundamental requirement in technical bids and a key differentiator among companies. At AKD International we stand out for our investment in automated equipment that prioritizes the safety

of our employees. For example, underground, we utilize modern equipment like the LM90, equipped with features such as a laser line that prevents entry into the danger zone. Additionally, this equipment can be automated to operate autonomously for short periods. On the surface, all our equipment features similar safety characteristics, such as rod handler and hydraulic arms in cases like SCH-RAMM T685 and EDM 2000. By 2024, we are implementing hydraulic equipment that allows for safer and more efficient sample extraction, reducing direct interaction between employees and machines.

What are the main challenges and opportunities that Chile faces in the mining sector today?

In recent years, Chile has lost prominence due to the need to attract investment for exploration and development of new deposits. Tax and business policies need to be adjusted to encourage investment in this regard. Additionally, globally, there has been a shift towards Brownfield projects rather than Greenfield, which may limit the search for new deposits. However, the future demand for minerals such as copper and lithium, driven by electromobility and the reduction of fossil fuels, offers opportunities for the sector.

What opportunities does Chile's lithium sector present AKD International?

AKD International in Chile has had the privilege of participating in the drilling of prominent salt flats in the country, which has been an invaluable experience that has positioned us as a solid option in the lithium sector. We have learned about the complexities of drilling different types of salt flats, providing us with valuable experience and preparing us for future projects in this field. Currently, we are in negotiations with three major mining companies for the execution of drilling programs in salt flats, demonstrating the confidence that the sector places in our experience and capacity.

We recognize the need for greater technology and logistical support in the field of salt flat drilling, and we are committed to continuing to develop our capabilities in this area. We believe there is a significant opportunity for mining support companies in the lithium sector, and we are focused on maintaining controlled costs while seeking organic growth that ensures the sustainability of our business in the coming years. ■



Business Insights on Safety



Jean Paul Droguett, General Manager, MINCON

“Mincon was the first drilling provider to innovate with the end goal of safety, leading us to be the first company to introduce the Handler Truck with its remote-controlled drill pipe manipulators.”



Trinidad Carmona, Co-CEO, DRILLCO

“The replacement of bars in drill rigs poses risks for workers and results in productivity loss. We developed SafeTruck to automate this process, reducing the time to replace bars from 4.5 hours to 28 minutes, and the required personnel to just two people.”



Daslav Curkovic, VP New Business Development, PRO DRILLING

“Our clients are willing to invest in safety, which is why we partner closely with major mining companies. These firms are prepared to cover the higher costs associated with incorporating advanced technology to ensure safer operations.”



Ignacio Bello Marambio, General Manager, DIAMANTINA CHRISTENSEN

“Safety is our number one priority, so we constantly evaluate and improve our work areas and processes to increase productivity and minimize associated risks. We have automated some of our processes by incorporating automatic arms and creating autonomous work cells, always supervised by an operator.”



Jorge Blázquez Hernández

LATAM Regional Manager
MAXAM

“By locating our factories within mines, we can increase the volume of supplied explosives and efficiently address demand peaks.”

Can you summarize Maxam's activities over the past two years?

Our focus has been on expanding our presence in Chile, resulting in an increase in our market share from 10% to 30%. We have secured major contracts with key companies like Capstone Copper and Codelco, while also renewing existing contracts like Escondida for an additional 10 years. Our strategy has involved organic and non-organic growth, supported by substantial investments in technology. Notably, we are the only company with manufacturing facilities within mines. Currently, we operate plants in Minera Escondida, and have plans to establish additional facilities in Gabriela Mistral and DMH. This allows us to offer modular solutions with rapid implementation, optimizing logistics and supply chain security, especially in response to challenges like the 2022 truckers' strike. As a result, we can now provide our clients with up to three weeks of supply security. We have also been focusing on reusing residual oils in our manufacturing process, enabling sustainable operations without relying on diesel consumption.

What are Maxam's most notable projects in Chile?

Our flagship project is Minera Escondida, which facilitated our entry into the Chilean mining sector. Since 2016, we have undertaken numerous initiatives with them and developed our capabilities in the country. We invested nearly US\$50 million, constructing three

manufacturing plants and establishing comprehensive logistics, including nitrate storage areas. We have progressively optimized the project, reducing load factors, improving productivity, and adopting new technologies, including the reuse of residual oils.

How does Maxam increase productivity in the context of declining ore grades?

By locating our factories within mines, we can increase the volume of supplied explosives and efficiently address demand peaks. We have improved the technology of our loading trucks, increasing their capacity and explosive discharge speed. Additionally, our X-Energy solution allows us to adjust the energy of explosives based on rock characteristics. Through data collection and mathematical modeling, we determine the exact quantity of explosives required for fragmentation. This optimizes explosive consumption and boosts productivity. We can also expand drilling meshes to increase production using more energy-efficient products.

What is Maxam's approach to R&D?

We have an innovation and development center at our factory in Páramo de Masa, Burgos, which was set up about five years ago. This center serves as a hub for R&D and engineering activities, as well as for the development and manufacturing of plants and trucks. The development process is characterized by close col-

laboration and a multidisciplinary approach, with teams working together to address the needs of the sector and our customers. We are very agile and fast in the transition from the identification of a need to the implementation of a solution, thanks to a testing field where innovations are tested before being implemented on an industrial scale.

Can you elaborate on Maxam's ESG policy?

Our policy is to offer equal opportunities to everyone, regardless of gender, beliefs, etc. We are committed to including women in the mining industry, but we face the challenge of a shortage of women with specific experience in areas like blasting or explosives. To address this, we have implemented training programs, such as a six-month workshop attended by 60 women last year. This year, we plan to repeat it with the aim of achieving 45% female representation. We have also established an integration committee where women and other minority groups can express concerns and contribute to creating an inclusive environment for all employees.

What challenges does the blasting sector in Chile currently face?

Our main challenge is the shortage of raw materials due to the war in Ukraine, affecting the availability of key products like TNT and booster. This has led us to seek alternatives beyond local suppliers and reconsider nitrate imports. We face pressure from the mining industry to transition to greener explosives and to comply with stricter regulations while facing rising operational costs. These challenges require us to improve productivity and generate greater long-term value.

What are Maxam's objectives for the coming years?

Our main goal is to complete technological implementation in Chile, including the establishment of modular plants and the transition to greener explosives. We also want to consolidate digitalization and value propositions like X-Energy. Chile is a crucial market for Maxam and this year we plan to double our size in the country. ■



Cristian Cifuentes

General Manager
Chile & Argentina
ORICA

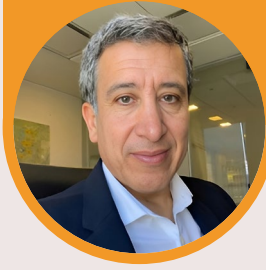
What technological advancements has ORICA made recently?

We introduced our new 4D technology, an advanced explosive product that enhances energy distribution, making explosive use more efficient and cost-effective. Following Australia's lead, we are the second region to adopt this tech in an underground setting. WebGen, the only wireless detonation technology available globally, is advancing to its second generation. Our digital solution, Rhino, has been pivotal in improving rock mass recognition and optimizing our blasting designs for better client outcomes.

What is ORICA's approach to ESG?

A key aspect of this approach is our capability to quantify carbon emissions for each blast. This ensures we can monitor and optimize environmental impact. ORICA is dedicated to achieving net-zero emissions by 2050, with an interim goal of reducing emissions by 40% by 2030.

Socially, we established the School of Operators, aimed at enhancing female participation across all levels of our operations. This program has enabled women to advance into roles such as supervisors or operators of explosive trucks. In 2023, female representation in the company was at 15%. Our goal for 2024 is to increase to 20%. ■



Patricio Picero

General Manager
ROCKBLAST

Can you introduce us to Rockblast mining technology?

Recognising the need for technical information on the vibrations generated by blasts and the inefficiency in capturing this data, an opportunity for innovation was identified. Blast Monitor was created, monitoring stations that capture field data online and in real-time, providing mining clients with a tool for more agile and timely management and decision-making. They integrate data on vibration measurements for blasting and slope stability.

In 2017, the company identified that many tasks required manual fieldwork, exposing people to operational risks. This created an opportunity to move towards digitalisation, incorporating autonomous drones into operations, allowing for greater information capture in a safer and quicker manner.

What do mining clients currently demand from technology providers?

The demand for profitability and safer operations drove the company to seek the development of new technological applications. Data processing and transfer allowed simulators to virtualise operations and manage them remotely. Technology is a great enabler of value. We do not incorporate technology and innovation for the sake of it; we do it to provide our clients with better business results. ■



Pablo Wallach

VP Technology, Innovation
& Marketing
ENAEX

What contributed to Enaex's inorganic growth in 2023?

We wanted to standardize the tools we have for designing blasts, so we partnered with ForcIt in O-Pit blast, to have an influence in the development process and customize the software to our needs. We also completed the acquisition of MTI Group, manufacturers of blasting accessories.

What technologies has Enaex developed recently?

We developed a new version of Enaex Bright, a platform that utilizes machine learning to predict bench hardness based on data from previous benches.

On the initiation system front, we are releasing the DaveyTronic® 5 (DT5), with increased delay options, expanded temperature range for operation, and improved blast customization. We are updating our range of firing units and equipment to complement the new detonator. We are also launching a contactless solution in electronic initiation systems, allowing for blasting without the need for surface cables.

In robotics, we are nearing completion of our Roboprimer development, aimed at automating the priming process in open-pit mining operations. This addition completes the cycle of our teleoperated explosive loading trucks, enabling fully teleoperated blasting services. ■



Felipe Schneider and Gülden Ergün

FS: General Manager
GE: Mining Sales Manager
BASF CHILE

How does BASF help companies optimize mineral extraction in Chile?

GE: In Chile, in general minerals are complex so the process of extraction is also intricate, and very time-consuming. In that frame of complexity, we have solutions that increase the efficiency while reducing freshwater consumption and process time. Our flocculant Rheomax DR, an advanced polymer with high density, allows for water recovery up to 7% and reduces carbon emissions. This water can be reused or, after treatment, returned to the ecosystem. For leaching, we have a product called LixTRA, a powerful reactive that increases copper recovery by 3-5%, while not impacting SX-EW processes as well as reducing the impact on the environment and costs.

Besides performance, we also work with tools which measure carbon footprint of our products and solutions in client processes.

What solutions is BASF integrating to meet Chile's challenges?

FS: In Chile, there is the challenge of using more renewable energy. The issue is that energy availability must be continuous and there is a bottleneck problem in transmission. BASF has a solution that allows continuous energy supply, which is a sodium-sulfur battery. They deliver energy for 6-8 hours. Lithium batteries, on the other hand, only deliver energy for 5 hours. During the day operations can be run with solar energy, and the supply can be maintained with our batteries during the night. Sodium and sulfur are both abundant elements and the batteries have a use life of 20 years, making them a perfect sustainable alternative.

Another challenge is circular economy and recycling. To address this, we offer a product line called B Cycle, designed to enhance plastic recyclability.

What are BASF's goals?

GE: Our focus remains on improving process efficiencies to deliver enhanced outcomes. ■



Daniel Araya

General Manager
POCHTECA CHILE

Can you introduce us to Pochteca in Chile?

The company started in Mexico in the paper business, and slowly expanded into chemicals and distribution. We have grown organically and inorganically, acquiring companies across Latin America. We entered the Chilean market in 2020 by the acquisition of Ixom operation in Chile. We have established a robust presence in the mining sector, with our mining division encompassing both mineral processing and hydrometallurgical processes. Our expertise spans mineral flotation, water treatment, copper solvent extraction, and copper electrowinning. We operate five laboratories nationwide. In addition to our core services, we are actively engaged in projects such as developing ethylene glycol recovery products for trucking and mining operations. We also provide a series of associated services, including warehousing and inventory management, environmental services, and customizable chemical services for our mining customers.

What trends in demand are you seeing from your mining clients in the past year?

Clients demand ever better service. Today, they approach distributors more and more, because they want an end-to-end service; we can not only source raw materials but deliver them to the sites, mix the chemicals and produce a finished product, saving them many steps along the way. There is also a lot of demand for our environmental services, such as the recovery of ethylene glycol and waste management from chemical byproducts. One of our biggest contracts in mining entails primary material sourcing, warehousing and management, through treacherous mountainous geography, managing all of these complicated logistical steps along the way. We provide a holistic, integrated service because not all of our customers have the capacity to handle and manage these materials from end to end.

What are the challenges in Chile?

There have been challenges for distributors in the past year due to container price volatility and increasing prices for raw materials, which led to some overstocking across the industry. ■



Infrastructure and Logistics

Modularization moves mountains

Modularization has emerged as a strategy to improve flexibility, efficiency, and scalability while reducing costs. Modularization involves breaking down complex systems or processes into smaller, self-contained, and standardized units, called modules.

Putting the pieces together

In the infrastructure segment, modularization takes form through modular construction—the process of constructing buildings or structures in sections (modules) in a factory setting. These modules are transported to the construc-

tion site and assembled into the final structure. Modular construction within the mining sector is not new, but as the demand for Chile's metals soars and capital in the industry dwindles, it is becoming increasingly popular. "Mining is catalyzing a global reevaluation, revealing the indispensable role of modular construction. Situated in remote locations, mining demands stringent security and quality standards, but at the same time, the costs of operating in mining are high, and time is gold," said Cristóbal Schneider Guzmán, general manager at Promet.

40% of Chile's copper is produced from mines located at altitudes above 3,000 meters (9,800 ft) above sea level. Building facilities that can withstand harsh weather conditions at high altitudes (e.g., strong winds, freezing temperatures) often results in a 20-30% increase in construction costs compared to similar facilities at lower altitudes. "The mining industry in Chile presents unique challenges due to its remote locations, adverse weather conditions, and limited resources," said Pablo Rosales CEO at Tarpulin. "Modular solutions are ideal for this sector, offering cost-effective alternatives to traditional construction methods. Furthermore, given the prevalence of temporary projects in mining due to environmental constraints, modular construction emerges as an efficient and environmentally responsible option".

Chile is one of the most seismically active countries in the world, experiencing over 1,000 earthquakes a year. This raises construction costs. Modular construction provides a solution. Tecno Fast constructed a seven-story 34,000 square-meter wooden hotel for Anglo American in one month. "To ensure its safety and stability in response to earthquakes, we carried out detailed testing, placing modules on a platform to simulate seismic stress and testing them up to seismic grade 12. These tests showed that the modules could withstand significant seismic forces without failing," said Cristián Goldberg Aichele, general manager at Tecno Fast.

The benefits of modular construction can be felt before the construction even begins. "Modular solutions allow us to work with our clients earlier in the design stages. By assisting earlier in the process, we can greatly impact construction workflow productivity, improve assembly safety, and reduce environmental footprint," said José Luis Villalón, general manager at Hilti.

The factory setting of modular construction also enables benefits. "Prefabrication reduces emissions and pollution by centralizing manufacturing in environmentally responsible facilities. Modular solutions can be disassembled, reused, or repurposed, providing sustainable solutions over time," said Tomás Fischer Ballerini, general manager at Edyce.

Modular construction also allows for unique ways to support sustainability in the sector. In their construction of warehouses for client SQM, Tarpulin introduced the circular economy into the modular construction space. "Our modular floor is made in Chile using recycled plastics (HDPE) instead of traditional concrete slabs," said Rosales.

Logically modular

Modularization is also being applied in the logistics space to save time, increase efficiency and safety, and lower emissions.

Logistics company Mammoet is involved in the Front-End Engineering Design (FEED) stage, allowing the firm to integrate transportation logistics into the design process. "Mammoet completed the transportation and installation of a ship loader for a prominent mining client. We introduced a modular approach for this client, transporting their load in two sections instead of numerous smaller loads," said Vanessa Labana, sales manager Chile at Mammoet. "This not only streamlined the assembly process but also enhanced safety," Labana continued.

Mintral, a mining logistics firm, found that designing shipment containers with a modular approach benefits them. "Our adapted containers have trays in the middle of the truck which allow us to combine two trips into one, providing economic savings for clients and improving safety by reducing the number of trucks on the road," said Phillip Schaale, general manager at Mintral. "This initiative saved 5,000 trips last year, equivalent to 3,200 tons of CO2 emissions."

The ease and speed of modular construction allows for fast and cost-effective mine development while driving the industry towards safer, and more sustainable solutions. ■



Vanessa Labana
Sales Manager Chile
MAMMOET

“ We introduced a modular approach for a client, transporting load in two sections instead of numerous smaller loads, which streamlined the process and enhanced safety. Embracing modular construction methodologies is key for the mining industry. ”



Tomás Fischer Ballerini
General Manager
EDYCE

“ Modular solutions can be disassembled, reused, or repurposed, providing sustainable solutions over time. Unlike traditional methods that often require constant renewal, modular approaches offer enduring value. ”

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Cristóbal Schneider

General Manager
PROMET

Can you introduce Promet?

Behind every mining project is a support system that turns visions into reality, starting with construction and essential services. We transform deserts into operational mini-cities, laying the groundwork for mining and energy projects. Our journey began over thirty years ago, and since then, we expanded our services to include the engineering and construction of mining camps, alongside operating hotels that cater to the mining and energy sectors. As Promet grew, we ventured into the modular sector outside of mining, though 50% of our modular services service the mining industry's needs.

In 2023, Promet was recognized three times across various sectors for outstanding safety standards, notably by Codelco on two occasions.

How has client demand impacted Promet's offerings?

Driven by the evolving demands of major mining companies in Chile, Promet is embracing innovation to enhance the sustainability and community integration of our camps. We are collaborating with these companies to explore modifications to our camp offerings, focusing on key improvements like water reuse, creating more pleasant living environments for workers, and fostering positive relationships with local communities. This transition challenges us to differentiate ourselves and be disruptive in our approach.

“ We transform deserts into operational mini-cities, laying the groundwork for mining and energy projects. ”

What led to the emergence of modular construction in mining and what is its future?

Mining is catalyzing a global reevaluation, revealing the indispensable role of modular construction in industries where time is scarce and costs are high. Situated in remote locations, mining demands stringent security and quality standards, but at the same time, the costs of operating in mining are high, and time is gold. Here, modular construction emerges as a sustainable solution, enabling rapid development and resource exploitation. However, the challenge lies not just in sustainability but in achieving efficiency and financial viability.

The essence of the challenge for Promet and the wider industry is scalability. Sustainability alone is not enough; scalability is crucial to broaden the impact, making environmentally friendly and community-centric construction accessible to all. This balance between sustainability, scalability, and financial feasibility represents the future of modularized construction.

What is Promet's approach to ESG?

Our ESG initiatives prioritize community engagement, particularly through our hotel operations that accommodate up to 4,000-5,000 guests at peak times. The significance of our hotel staff, many of whom are residents of nearby towns, cannot be overstated. Collaborating closely with local com-

munities is essential for making our hotel projects successful.

We are committed to environmental responsibility, particularly in waste management and material usage. Modular construction generates 10 times less waste than traditional methods, but we acknowledge there is still waste. Leveraging steel—a shift from our previous focus on wood—enables us to substantially reduce this footprint. Steel not only offers superior recycling opportunities compared to wood but also represents a forward-looking choice for sustainable construction.

What shifts are currently taking place in the mining industry?

2023 was a year of stabilization. Although this stabilization has not yet materialized, the industry is showing signs of growth. Promet is one of the first companies to be contacted in the cycle of growth in the mining industry. When the mining companies make the decision to expand operations or start new ones, the first necessity is the construction of camps. At the end of 2023 and beginning of 2024, we have seen projects within the pipeline accelerate. From the point of view of our project pipeline, 2024 will be a year where certain permits will be granted which will enable the next five or six years quite positive for the industry. The stakeholders behind permitting are starting to take responsibility and approve permits. In terms of mining, Chile is currently paralyzed. It needs this growth.

What is Promet's vision?

We aim to be the leader in modular construction services in Chile. Our goal extends beyond our foundational work in mining to modular housing. We are looking to offer added value to our mining clients through sustainability-focused initiatives, particularly by developing 'green camps.' Our vision is to be at the forefront of modular construction in the mining industry, emphasizing sustainability and environmental stewardship. Mining companies are increasingly adopting responsible environmental practices, and we are committed to aligning with this shift, ensuring that our contributions resonate with the current and future needs of our clients and the planet. ■



Cristián Goldberg Aichele

General Manager
TECNO FAST

“ One of the year's major successes was building three camps for 5,500 people for Collahuasi. It was our largest project to date and demonstrated our ability to overcome logistical challenges and deliver on time, within budget, and safely. ”

Can you provide highlights from 2023 for Tecno Fast?

During last year, a key milestone was acquiring 85% of Balat, a leading modular construction company in Spain, which specializes in office and workspace rentals and sales. This venture is in line with our operations in Chile and represents a crucial step toward realizing the vision of becoming a globally recognized company. Our international operations also include the United States and Peru, where we have established a production plant and rental service.

One of the year's major successes was building three camps for 5,500 people for Collahuasi. It was our largest project to date and demonstrated our ability to overcome logistical challenges and deliver on time, within budget, and safely, reaffirming our commitment to high-quality and safe solutions.

What does the achievement of the Mutual Gold certification signify for Tecno Fast?

Our work with Codelco's Radomiro Tomic led Tecno Fast to become the first company to achieve the Mutual Gold certification. The project includes the construction of seven modular buildings and areas for hazardous waste. This accomplishment highlights our excellence in industrial assemblies and supports our commitment to providing effective risk control methods and personalized support to our clients. Our approach is to maintain close relationships with the clients, listen to their needs, and offer comprehensive solutions, which is fundamental to our growth and client-centric focus. This recognition highlights our hard work, effective leadership, and strong teamwork between us, our clients, and our subcontractors.

Can you provide an example of Tecno Fast's anti-seismic design?

We constructed a seven-story wooden building for Anglo American that is currently noted as the tallest wooden structure in South America. This building includes six floors, with the seventh serving as a roof and technical space. To ensure its safety and stability in response to earthquakes, we carried out detailed testing, placing modules on a platform to simulate seismic stress and testing them up to seismic grade 12. These tests showed that the modules could withstand significant seismic forces without failing.

What measures has Tecno Fast taken to enhance its sustainability practices?

In comparison to traditional building methods, modular construction is more eco-friendly, mainly because it utilizes wood. This material is known for its environmental benefits, including its capacity to store carbon, contributing to the sustainability of our products. Our buildings are also constructed entirely off-site. This minimizes environmental impact because we do not have to bring large equipment into mining sites, which can disrupt the local flora.

In our factory, we are working towards a zero-waste goal and have already achieved a 60% recycling rate for our waste thanks to the collective efforts of our team and the implementation of new practices. Efficient processes can be negated by unsustainable packaging. Therefore, we are collaborating with our suppliers to reduce the use of non-recyclable packaging materials. Our automated plant in Lampa is entirely powered by solar energy. In 2023, we made significant progress by installing solar panels at our Colina plant, resulting in 80% of its energy consumption being solar-powered.

Our sustainability committee, which has been operational for nearly two years, is working on a carbon footprint emission calculator, which is a significant achievement given that our operations encompass production, logistics, assembly, and supplier management. This calculator is a crucial tool for understanding and mitigating our environmental impact. We are now looking to use this calculator not only to offset the carbon footprint of the company but also to engage our customers in sustainability efforts.

What does the future hold for Tecno Fast?

Our presence in Chile has been a constant and it makes up around 65% of Tecno Fast's global operations, therefore we will continue operating within the country. Meanwhile we are also looking for opportunities in Canada and Australia. Also, we are focused on consolidating the acquisition of Balat. Moreover, we are launching a tent-renting service in March, which will be a nice addition to our portfolio.

Our main purpose as a company is improving people's lives, which includes both the lives of our clients and our employees. One of our biggest goals is to ensure we have zero accidents. Also, we would like to continue consolidating in the mining industry, since we believe there is a lot of opportunity. We believe the future is modular. ■



“ Approximately 40% of our modular construction production occurs in our local factory in Chile. ”

Pablo Rosales

CEO
TARPULIN

How did Tarpulin perform in 2023?

We sustained significant growth both in terms of project sales within the mining industry and in our rental division. Our catalog of solutions goes from temporary and permanent warehouses, dining rooms and miscellaneous buildings in general, to sustainable Made in Chile recycled heavy duty plastic floors, to satisfy the needs of mining companies and service providers in this industry.

What are some of Tarpulin's recent notable projects?

We highlight our project with SQM in the lithium sector, focusing on the provision of warehouses for storing soda ash, finished products and building of recurrent operational use for the client.

A significant innovation we are proud to introduce in this project is our modular floor made in Chile using recycled plastics (HDPE) instead of traditional concrete slabs.

This is a novelty in Chile, which brings multiple benefits including shorter construction periods, a safer operation and lower risks to our client's project, as delivery times are always relevant in a business decision.

Can you provide details about Tarpulin's achievement of ISO 20121 certification?

Tarpulin is the only company in Chile to obtain this sustainability certification, which we are very proud of and allows us to pass on this benefit of more sustainable projects to our clients.

What are the advantages of modular construction?

Modular construction offers numerous benefits, including safer projects in terms of delivery times and assembly, also standardized parts and pieces, reducing failures, additional costs to clients and unforeseen events. Although sometimes the modular construction companies face the challenge of carbon footprint stemming from imported component, that's why in Tarpulin we are focused on local manufacture modular construction solutions.

How does Tarpulin set itself apart from competitors?

We receive permanent feedback from our clients and we make sure that that information translates to improvements inside our company.

One of our main positive feedback from our clients is that they value working with Tarpulin as we deliver higher standards in compliance with the Chilean regulation.

In a market moving towards standardization, Tarpulin stands out for its ability to adapt to the specific needs of our clients. Our deep understanding of their operations allows us to offer personalized and safe solutions. We have extensive experience in various sectors, understand our clients' requirements in terms of volumes, stock rotations, inventory control, and material traceability, allowing us to provide added value to their operations. Our goal is to lead in the specific markets we serve to.

How has Tarpulin maintained supply stability amidst recent logistical challenges?

Approximately 40% of our modular construction production occurs in our local factory in Chile. This facilitates streamlined stock management and swift response to unforeseen events, providing security to our clients. We also maintain a large permanent stock and an extensive rental fleet of almost 300,000 square meters of modular structures.

What construction challenges do mining companies face in Chile?

The mining industry in Chile presents unique challenges due to its remote locations, adverse weather conditions, and limited resources. Safety and accident prevention are fundamental priorities, demanding high standards from suppliers. Tarpulin's mining team are specialized trained and expert in what they do. Modular solutions are ideal for this sector, offering cost-effective alternatives to traditional construction methods. Furthermore, given the prevalence of temporary projects in mining due to environmental constraints, modular construction emerges as an efficient and environmentally responsible option. We are very much focused on adding value to our customers with those principles.

How is Tarpulin planning to expand?

In a sustainable way, through technology, focused to reduce cost to our clients, delivering safer and more efficient projects. Proliferation of modular solutions is a reality in the market inspiring us to innovate even further. Currently, we are the only company in Chile that uses recycled Made in Chile modular floors to replace concrete. This was a large bet on sustainability both from us and from our clients, and we are succeeding with their support into these innovations and growth will follow. We have permanent presence in Perú and Brasil, also doing business with Ecuador and Latin America in general, with a permanent initiative to explore new business opportunities in the region. ■

PS



CC



Phillip Schaale and Christopher Collins

PS: CEO
CC: Manager of Mining
MINTRAL (SITRANS)

What services are offered to mining clients?

CC: Our core business revolves around logistics for supply chains in the mining industry. We manage the entire logistics flow from supplier coordination to scheduling, ensuring that we handle the pickup and transport of their cargo. Our goal is to receive and consolidate all cargo, optimizing the movement efficiently while adhering to the safety standards for each client.

We use Sitrack, our TMS or ERP logistics system, to track every step of the process, often integrating with our clients' ERP systems. If integration isn't possible, we provide manual integration to give clients visibility into the status of their orders.

How is digitalization incorporated into processes?

PS: We are focused on digitalization and incorporating electromobility to enhance our processes. We are digitizing all procedures, including service requests, online reporting, payment status, and utilizing technology for tracking. This allows us to monitor and trace our clients' cargo, preventing inventory discrepancies and ensuring they can always know the location of their cargo. ■



Tomás Valenzuela Somerville

Mining, Energy & Regional
Offices VP
AGUNSA

How was 2023 in terms of the mining market?

Last year, AGUNSA secured many new contracts, propelling us to the forefront as the primary logistics operator for Chile's mining industry. World-class companies such as Codelco, Sierra Gorda, Teck QB2, Antofagasta Minerals, Kinross, and Anglo American have placed their trust in us. Under these contracts, AGUNSA assumes responsibility for the handling, consolidating, and transporting of all inbound cargo destined for their sites nationwide, regardless of the port or airport of entry.

We expanded our operational network by inaugurating new logistics centers in Antofagasta, Copiapó, Talcahuano, and Punta Arenas. Moreover, we established a new import warehouse at Santiago airport to enhance our capabilities further.

In terms of exports, what did AGUNSA achieve?

AGUNSA made significant strides in the export mining sector. We were selected by the two new concentrator plants in Chile, Teck Qb2 and Capstone Copper Mantoverde, to handle the road transportation of copper concentrate.

Furthermore, last year we secured a long-term agreement for the international freight of molybdenum concentrate with a renowned mining company in Antofagasta. ■



Diego Rodríguez

General Manager
TERQUIM / ODFJELL
TERMINALS

What are the strategic advantages of Odfjell's Mejillones terminal?

Our ownership of the terminal grants us autonomy, enabling us to operate efficiently without the constraints often associated with third-party management. This autonomy is a strategic advantage, especially in a bay like Mejillones, known for high congestion, mainly in swell periods. Our terminal stands out for its low occupancy rate, which translates into valuable time savings for our clients. They can dock and unload their ships without the delays that are common in busier ports, making our terminal an attractive option for timely and efficient logistics.

Beyond handling chemicals, CPP, and diesel oil, we've extended our operations to include sulfuric acid reception at Mejillones.

What is Odfjell's value add for mining clients?

We position ourselves as a vital logistic alternative for mining clients in the country's northern regions, where industry congestion is notably high.

What does Odfjell's 50th anniversary signify?

In 2022, Odfjell chose to escalate investments in Chile, signaling our aim to embark on another 50 years in the country. ■



Maintenance

Increasing the sector's productivity

Article 22 of the Chilean Labor Code previously allowed for a 45-hour work week. The 40-hour bill, effective April 2024, will gradually reduce the maximum weekly working hours to 40 by 2028, aligning with the OECD average. Despite this alignment, Chile's worker productivity, measured by average hourly GDP contribution, remains below the OECD average. In 2020, each Chilean worker contributed US\$30.4 per hour to the GDP, ranking Chile 36th out of 39 OECD countries, significantly below the OECD average of US\$54.5 per hour. This indicates lower productivity and output per dollar spent on the workforce.

The Chilean mining sector faces additional challenges, including a potential shortfall of 34,000 qualified personnel

due to the green energy transition. This productivity challenge compels the industry to seek ways to maximize efficiency with existing resources. Maintenance companies in Chile's mining industry are dedicated to minimizing stoppages and ensuring optimal productivity.

Technology

Chile is a pioneer in the application and development of technologies, said Ludwig Hecker, CEO of Ferrostaal: "Chile is an extremely liberal economy, and that is a double-edged sword. On the negative side, the industry is not forced by regulation to walk the extra mile when it comes to decarbonization, but

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on the bright side, Chile is an attractive market to innovate and try new technologies and concepts."

Predictive maintenance technologies have gained particular attention, emphasized Elizabeth Torrejón, general manager Chile: "Companies trend towards taking predictive measures more than reactive measures, due to the high costs of mining and equipment shutdowns." This comes with reason, as stoppages can be extremely costly. For instance, the 44-day strike at Escondida in 2017 resulted in approximately US\$740 million in lost production and about US\$16.8 million in daily revenue losses.

Veltis LATAM realized that keeping mining plants free from pollution requires a large amount of labor and poses risks to workers. "To address this challenge, we developed technology that enables remote cleaning, eliminating the need to expose workers to hazardous environments and reducing the amount of physical effort required. This innovation allows us to improve productivity and safety in our operations while also reducing risk exposure for our personnel," said Marcelo Ocampo, the CEO of Veltis.

One way to meet the labor shortage in the industry is to reduce the number of onsite personnel. Maintenance firm Confipetrol has taken this to another level, allowing professionals anywhere in the world to work with their clients in Chile. "Confipetrol created remote assistance glasses, which facilitate the intervention of specialists from our maintenance engineering and reliability area, whether from Peru, Colombia, or another location, or even in collaboration with external providers, depending on the criticality of the failure. These glasses function like video calls, allowing a specialist to guide the technician in real time, projecting plans or instructions directly into their vision while they work," explained Jeant Peinado, business manager at Confipetrol.

Put it on a platform

To monitor the productivity of operations and assets, many maintenance companies have developed proprietary technological platforms to enhance client productivity. Nexxo, for instance, implements its Nexxcon platform to help clients achieve productivity and efficiency goals. "This tool has allowed us to manage data more effectively and in real-time, unlike before when data analysis was delayed. Now, we can proactively identify and address deviations in efficiency, significantly contributing to the continuous improvement of our processes," said Ignacio Pérez the general manager at Nexxo.

Technological platforms have shown tangible results. "We implemented a technological platform that allows real-time monitoring of the productivity of our mining contracts, providing a clear view of the results achieved," said Gonzalo Mardones, CEO of Salfa Mantenciones. "In specific projects, we reduced maintenance times significantly, from 36 to 18 hours, resulting in greater asset availability for our clients" Mardones continued.

Equans utilizes Asset Performance Management (APM) software with the same goals in mind. "It optimizes maintenance schedules based on actual asset usage rather than fixed intervals. This technology ensures maintenance is performed precisely when needed, based on the real condition and usage of the asset. It also reduces maintenance hours, which helps with sustainability," detailed Diego Clavería, chief commercial officer at Equans.

Advancements by maintenance firms illustrate the potential for technology to drive productivity improvements in Chile's mining sector, addressing both current inefficiencies and future workforce challenges. ■



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Jeant Peinado

Business Manager
CONFIPETROL

“ We have developed an ambitious five-year business plan for Chile, identifying a potential market of over US\$2 billion in services and potential tenders where we can participate. ”

Could you introduce to Confipetrol?

Confipetrol was born 20 years ago in Barrancabermeja - Colombia, initially focused on the Oil&Gas sector. In 2010, it began its expansion at a regional level, first Bolivia and then Peru, where it acquired an important construction and maintenance company, allowing it to diversify operations in different sectors. Since then, the organization has been providing comprehensive equipment operation and maintenance solutions and services to mining, energy, hydrocarbons and industry.

In 2019 we entered the Chilean market, facing challenges such as social unrest and the pandemic, obtaining our first contract and start of operations in 2021 in the energy sector. In 2022, we obtained additional contracts in the medium-sized mining sector, and in 2023 we managed to enter large mining, with an important electrical maintenance service in one of Codelco's main operations.

In 2024, we have been awarded a new service with an important gold producer in Chile, and we have been working hard to monitor our submitted offers and the structuring of tenders to which our potential clients have been inviting us.

What is Confipetrol's approach to safety in its operations?

Confipetrol has implemented a robust safety management system, consisting of more than 5,000 operational procedures. Recognizing the need to instill a safety culture, we enlisted a

third-party consultant to assess our practices. Their findings highlighted an initial reliance on constant supervision for safe behavior.

In response, we have shifted towards fostering an interdependent safety culture, where employees embrace safety values and adhere to protocols without constant oversight. This transformation aims to deepen employees' sense of personal safety responsibility.

Moreover, we have incorporated virtual reality technology into our training programs, allowing employees to simulate critical tasks in a risk-free environment. This innovative approach helps employees gain practical experience in identifying and mitigating risks, improving their ability to anticipate hazards and prevent accidents.

How does Confipetrol increase productivity and improve energy efficiency of operations?

Confipetrol, through its Integrated Management System and Service Management Model based on ISO55001, establishes the guidelines to guarantee the development of the activities framed within the scope of each contract. Thus, the specific conditions of the facilities, the operational process, the Client's standards and procedures are all evaluated. Confipetrol defines the tools and methodologies to be used, establishing appropriate action plans aligned with the operational reality of the processes under our responsibility.

Within the action plans that are established, tools focused directly on optimizing the productivity of resources can be considered, and these may include the measurement of Effective Time (of jobs), the SMED (Single Minute Exchange of Die), Operational Discipline or the 5“S”, all of this under monitoring and control through management indicators, which allow us to validate the expected results or make changes to the initially defined strategy.

Additionally, in our vehicle fleet we implement digital platforms to control fuel consumption and mileage, generating optimization alternatives and training in ecological driving of vehicles, allowing us to improve the energy efficiency performance index in our operations.

How have you managed to convey your quality in operations to newly hired employees?

To begin our operations in Chile, we supported ourselves with Confipetrol Andina, a leading company in the provision of maintenance services in the mining sector in Peru, transporting professionals who were in charge of instilling our policy and culture at the beginning of operations.

For our first service in Chile, we supported ourselves with local strategic partners and specialists in personnel recruitment. This, combined with the experience of foreign personnel, led us to the start of operations.

What are Confipetrol's objectives in Chile in terms of growth and overall development?

We have developed an ambitious five-year business plan, identifying a potential market of over US\$2 billion in services and potential tenders where we can participate.

We have been working hard with our business development area, participating in fairs and events in the industrial sectors of mining and energy that allow us to increase the visibility of our brand in Chile, renewing and updating our pipeline month by month, aiming for a growth of US\$100 million in sales, having the support of 3,500 employees and being recognized as a leading company in the provision of maintenance services at an industrial level. ■

GM



SS



Gonzalo Mardones and Soledad Santelices

GM: General Manager
SS: Sustainability Manager
SALFA MANTENCIONES

Could you introduce us to Salfa Mantenciones?

GM: Salfa Mantenciones stands out for its focus on mining projects, providing maintenance services for mining assets with an emphasis on system reliability. Since its inception in 2008, the company has experienced significant growth, tripling in size and expanding its presence. With a team of approximately 2,800 employees, Salfa Mantenciones is distinguished by its commitment to innovation and technology, constantly seeking to improve productivity and add value through technical and operational solutions. Its primary focus is on copper mining, although we are tentatively exploring opportunities in non-metallic mining, particularly in the lithium sector.

What are the services that have driven demand during the year 2023 and early 2024?

GM: The primary demand from our clients is centered around cost reduction. This situation was reflected in the decrease in project awards during the early months of this year, prompting us to rethink our strategies and operational approaches.

To address this, we have focused on enhancing the productivity of our contracts through the implementation of technological tools and process optimization. While technology plays a crucial role in this process, we also recognize the importance of having highly skilled and competent personnel. We invested in developing the skills and technical knowledge of our team to increase their productivity and efficiency at work.

Could you provide details about initiatives regarding gender equality in your company?

SS: At the corporate level, Salfacorp was the first company in the industry to obtain the Chilean certification for “Gender equality and work-life balance”.

GM: We are addressing the challenge of gender equity in mining through the training of women, given the limited female labor supply. We are establishing partnerships with educational institutions to attract and train potential female employees. Meanwhile, we adapt our facilities and policies to create an inclusive work environment. ■

Which services does Equans offers in the mining industry?

We offer operation and maintenance services of entire electrical systems. This includes the maintenance of the trolley assist, which is a truck electrification system. We also offer mechanical maintenance services, including predictive and corrective analysis of conveyor belts and mobile equipment. Currently, we are leaders in maintenance of climate control systems in Chile's mining industry with over 20 operating contracts.

Equans also offers digital solutions, with a focus on enhancing operational efficiency and extending asset longevity. Our services include contracts for Distributed Control Systems (DCS), Control Systems, Supervisory Control and Data Acquisition (SCADA) systems, and Continuous Emissions Monitoring Systems (CEMS). Additionally, we provide technology-driven contracts, such as Asset Performance Management (APM) systems, aimed at optimizing asset maintenance.

Equans, as an EPC contractor, consolidates its energy sector expertise to the mining industry, offering construction services for high-voltage substations, transmission lines, and trolley assist systems. With a track record of building more than 20 substations in Chile, we are extending these capabilities to mining, along with high-voltage electrical infrastructure projects. Additionally, we specialize in operation and maintenance of photovoltaic plants, operating c350 megawatts in Chile. Importantly, this service is also offered to the mining sector as support of sustainable and efficient operations.

How does Equans help mining clients in the shift towards electrification?

We on green initiatives, including the development of green energy and, specifically, green copper. We adopt various strategies to mitigate environmental impacts, with a notable focus on the trolley assist system. This solution transforms traditional, pollution-heavy trucks into fully electric vehicles. Equans is equipped to design, construct, and maintain the entire infrastructure needed for this transformation, including the catenaries and the transmission lines to power the system. ■



Ignacio Pérez

General Manager
NEXXO

What were Nexxo's main milestones in 2023?

Nexxo has undergone a significant transformation in the last six years due to its acquisition by the Echevarría Izquierdo group. The full consolidation of this acquisition last year marked a significant milestone, making us part of a group with a strategic focus on the mining sector.

In 2023, we focused on strengthening our sustainability efforts, addressing aspects such as gender equality and work-life balance. We achieved certification under gender equality standard NCH 3262.

Furthermore, in 2023, we solidified our position as key players in the mechanical maintenance market. Following contracts in mines like Chuquicamata and Candelaria, our experience led us to secure a five-year contract in the crushing concentrator of Codelco's division El Teniente mine. This positions us as a prominent player in mining maintenance.

Can you highlight some of Nexxo's key projects in Chile's mining industry?

Last year, we signed a contract with Kinross to manage the tailings facility at La Coipa. We are participating in another similar tender but with significantly larger volumes at Codelco's Andina division. We see great potential in tailings management and environmental issues in Chile. ■



Elizabeth Torrejón

General Manager Chile
FLANDERS

Can you introduce us to Flanders?

Flanders is a global leader in the provision of engineering services, maintenance and manufacturing of electric motors of various sizes and characteristics. We develop control systems and automation for mining equipment globally. At our core, we provide integrated solutions to increase productivity and modernize processing plants, and we offer predictive maintenance services to allow customers to remotely monitor equipment health, perform data and vibration analysis. We have been present in Chile for 15 years, situated in the city of Antofagasta. Locally, we provide electric motor repair services, field services, ARDVARC autonomous systems conversions and other products.

What is the company's strategy for the coming year?

We want to become our customer's strategic partners, to foster long term relations with them, by providing integrated solutions. Of course, promoting our new products and service offerings in the Chilean mining market is also important. For Flanders, quality, safety and care of the environment are all essential to make sure that our carbon footprint is reduced, our customers are satisfied, happy employees and that the communities where we operate are not impacted. ■



Marcelo Ocampo

CEO
VELTIS LATAM

What are the services currently generating the highest demand for the company?

The predominant demand for our services focuses on plant maintenance, covering a wide range of operational areas, from primary crushing and milling to flotation and leaching processes. Additionally, it includes maintenance of wet and dry areas, filter plants, desalination plants, and pipelines around mines. As for the lithium sector, although its production process differs from traditional mining, it also requires constant maintenance due to its chemical nature and the importance of operational efficiency.

Could you highlight a technology that Veltis uses to improve productivity?

A specific example is our innovation in the area of industrial cleaning in mining. Traditionally, keeping plants free from pollution requires a large amount of labor and poses risks to workers. To address this challenge, we developed technology that enables remote cleaning, eliminating the need to expose workers to hazardous environments and reducing the amount of physical effort required.

What are the goals and objectives that the company has established for the next two years?

We aim to consolidate our presence in the lithium sector. ■

COMPANY	WEBSITE
ABB	https://new.abb.com/south-america
Aclara Resources	https://www.aclara-re.com/
Adionics	https://www.adionics.com/
Aggreko	https://www.aggreko.com/es-cl
Agunsa	https://agunsa.com/
AK Drilling	https://akdint.com/
Altiplano Metals	https://apnmetals.com/
American Salars	https://americansalars.com/
Amerigo Resources	https://www.amerigoresources.com/
Amphos21	https://www.amphos21.com/
AMSA	https://www.aminerals.cl/
Andritz	https://www.andritz.com/group-en/chile-andritz
APRIMIN	https://aprimin.cl/site/
ASTEC	https://www.astecindustries.com/
Astra Exploration	https://astra-exploration.com/
Atex Resources	https://www.atexresources.com/
Atlas Copco	https://www.atlascopco.com/es-cl
AUSENCO	https://ausenco.com/es/
BASF	https://www.basf.com/cl/es.html
Battery Minerals Resources	https://bmrcorp.com/
BBA	https://www.bba.ca/cl-es
Bechtel	https://www.bechtel.com/
BFS	http://www.bfshile.com/
BHP	https://www.bhp.com/es/what-we-do/global-locations/chile
CAPSTONE COPPER	https://capstonecopper.com/es/
CBB	https://cbb.cl/
CEIBO	https://www.ceibo.tech/
CleanTech Lithium	https://ctlithium.com/es/
CODELCO	https://www.codelco.com/
Confipetrol	https://confipetrol.com/
Consejo Minero	https://consejominero.cl
CRU	https://www.crugroup.com/
Cummins	https://www.cummins.cl/
DELPRO	https://delpro.cl/
Diamantina Christensen	https://www.diamantinachristensen.com/
Drillco	https://www.drillco.com/
DSI Underground	https://www.dsiunderground.com/es/
EDYCE	https://www.edyce.com/
Enaex	https://www.enaex.com/cl/es/
Endress + Hauser	https://www.cl.endress.com/es
EPIROC	https://www.epiroc.com/es-cl
Equans	https://www.equans.cl/
ERAL	https://eralchile.com/
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Fastpack	https://www.fastpack.cl/21/
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FILO Corp	https://filocorp.com/
FLANDERS	https://www.flandersinc.com/
FLSmidth	https://www.flsmidth.com/en-gb/es
Fluor	https://www.fluor.com/
Fourthane	https://fourthane.com/
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GEM	https://www.gem-mining-consulting.com/
GLENORE	https://www.glencore.cl/
Glencore Technology	https://www.glencoretechnology.com/es/
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Hexagon	https://hexagon.com/es/company/divisions/mining
Hilti	https://www.hilti.cl/
Hitachi Energy	https://www.hitachienergy.com/latam/es
Hofmann Engineering	https://www.hofmannengineering.com/
Hot Chili	https://www.hotchili.net.au/
Howden	https://www.chartindustries.com/



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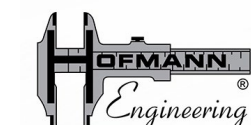


GLENCORE TECHNOLOGY

HAVER & BOECKER



NIAGARA



COMPANY	WEBSITE
Ingenelse	https://www.ingenelse.cl/
Innovations in Mining	http://www.imspa.cl/
JCB	https://www.jcb.cl/
JRI	https://www.jri.cl/
Kinross	https://www.kinrosschile.cl/portada/default.aspx
Knight Piesold	https://www.knightpiesold.com/en/locations/chile/
Komatsu	https://www.komatsulatinamerica.com/chile/
Lake Resources	https://lakeresources.com.au/
Len Ingeniería	https://www.len.cl/
Lithium Chile	https://lithiumchile.ca/
Los Andes Copper	https://losandescopper.com/
Madeco by Nexans	https://www.nexans.cl/es/
Magotteaux	https://www.magotteaux.com/es/
Mammoet	https://www.mammoet.com/
Marimaca Copper Corp	https://marimaca.com/
Master Drilling	https://www.masterdrilling.com/es/
MAXAM	https://www.maxamcorp.com/es/
MC SYSTEM	https://www.mcsystem.cl/
MetaProject	https://www.metaprojectgroup.com/
Metso	https://www.metso.com/es/
Michelin	https://www.michelin.cl/
Mincon	https://mincon.com/
Minesense	https://minesense.com/
Ministerio de Minería	https://www.minmineria.cl/
Mintral	https://www.mintral.cl/
Montero Mining & Exploration	https://monteromining.com/
Multiservice grúas	https://multiservicegruas.com/
Más Errazuriz	https://www.maserrazuriz.cl/
Nexxo	https://www.nexxo.cl/
Noa Lithium	https://www.noalithium.com/
Odfjell terminals	https://odfjellterminalsouthamerica.com/
Orbit Garant	https://orbitgarant.cl/
Orica	https://www.orica.com/
OSSA	https://ossaint.com/
Pares&Alvarez	https://www.pya.cl/
Pochteca	https://chile.pochteca.net/
Prodrilling	https://www.prodrilling.com/
PROMET	https://www.promet.cl/
R&Q ingeniería	https://www.rq.cl/
Rockblast	https://rockblast.cl/
Salfa Mantenciones	https://salfamantenciones.cl/
Sandvik	https://www.home.sandvik.es-la/
Scania	https://www.scania.com/cl/es/home.html
Seequent	https://www.seequent.com/es/
Shimin	https://shimin.cl/
Sigdo Koppers	https://www.skic.com/
SK RENTAL	https://www.skrental.com/
Skava Consulting	https://skava.cl/
SKF	https://www.skf.com/cl/
SONAMI	https://www.sonami.cl/v2/
Sonnedix	https://www.sonnedix.com/
SQM	https://www.sqm.com/
SRK Consulting	https://www.srk.com/es/contactenos/chile
Statkraft	https://www.statkraft.cl/
Stantec	https://www.stantec.com/es/offices/santiago-chile
STM Corp	https://stmcorp.cl/
Summit Nanotech	https://www.summitnanotech.com/
Syensqo	https://www.syensqo.com/en/
Systra-Subterra	https://subterra-ing.com/
Takraf	https://www.takraf.com/
Tarpulin	https://www.tarpulin.cl/
Techint Ingeniería y Construcción	https://www.techint.com/es/

COMPANY	WEBSITE
Technosteel	https://www.technosteel.cl/
TECK Resources	https://www.teck.com/es/
Tecno Fast	https://tecnofast.cl/
Tecpromin	https://www.tecpromin.cl/new/
Terra Nova Technologies	https://www.tntinc.com/es/
Tesoro Gold	https://tesorogold.com.au/
THIESS	https://thiess.com/es/
TI Mining	https://www.timing.com/es/
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TORSA	https://torsaglobal.com/
Tribeca Resources	http://tribecaresources.com/
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Turner & Townsend	https://www.turnerandtowntsend.com/
Valmet	https://www.valmet.com/es/
Vantaz	https://vantaz.com/
Veltis Latam	https://www.veltislatam.com/
Veolia Chile	https://www.latinoamerica.veolia.com/es/
Veracio	https://www.veracio.com/
Verai	https://ver-ai.com/
VIALCORP	https://vialcorp.cl/
Weir Minerals	https://www.global.weir/es/
Wood	https://www.woodplc.com/
Worley	https://www.worley.com/
WSP	https://www.wsp.com/es-cl/
XCMG	https://xcmg.cl/
Yokogawa	https://www.yokogawa.com/sa-es/



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