



Lagunas Norte Mine, La Libertad Pierina Mine, Ancash







Dear Reader,

Despite its faults and recent episodes of corruption and political drama, Peru continues to be perceived as a favorite destination for mining investors. This is proven by the renewed dynamism of its exploration market and by the recent investment announcements. In July, Anglo American made official its decision to build the US\$5.3 billion Quellaveco copper mine, while in August Minsur started pre-stripping activities at the US\$1.7 billion Mina Justa copper operation.

These moves show that mining is a long-term business, and the recent bickering of the United States' trade battles with countries like China and Turkey should not change the overall direction of the industry. The global demand for metals is not expected to decrease in a world that continues to see population growth, increasing urbanization rates and a true renewable energy transformation.

Moreover, taking new metals to the market is no easy task, as shown by maturing mines with lower grades and higher production costs, socio-environmental constraints that limit new project developments and expansions, and labor issues that have put massive operations on hold, as we have seen in Chile with Escondida.

In Peru, increased mining investment is expected to translate into stronger GDP growth, now forecast at 4% for 2018 according to Peru's Central Reserve Bank. This is excellent news for the country, because last year the economy had cooled down and only grew by an insufficient 2.5%.

In this context, Global Business Reports has forged a strategic partnership with the Canada-Peru Chamber of Commerce, an institution that promotes commercial relations and investment and which is the country's leading binational mining chamber, in charge of organizing every year the Peruvian presence at the PDAC Convention in Toronto. The result of this collaboration is the production and distribution of 'Industry Explorations - Peru Mining 2018', an up-to-date review of the current operations and projects and the latest trends in Peru's mining industry.

The book is a comprehensive guide of the different companies involved in Peru's mining food chain, with attention to hot topics such as the battle for talent (and the need to incorporate more female workers), the return of grassroots explorers, the introduction of new mining and processing technologies and, on the negative front, the surge in the number of mining fatalities over the last two years.

We have invested several months to properly research the market and meet face to face the most important institutional leaders and industry executives, including current president Martín Vizcarra. Once again, we want to thank all of them for their time and collaboration. We also thank you for choosing 'Industry Explorations - Peru Mining 2018' as your source of information about Peru's mining industry.



Alice Pascoletti General Manager



Carla Martínez General Manager

Introduction to Peru

- 8. A New Government for a New Mining Cycle
- 11. Interview with the president of Peru
- 12. Interview with SNMPE
- 13. Pushing the Project Pipeline
- 14. Interview with Minsur
- 15. Interview with Bear Creek Mining
- 16. The Social Aspect of Mining
- 17. Interview with IFC
- 18. Open for Business
- 19. Interview with Canada-Peru Chamber of Commerce
- 19. Interview with Dentons
- 20. The Battle for Talent
- 21. The Role of Women in Peru's Mining Industry
- 22. Interview with Korn Ferry
- 22. Interview with Transearch

Mining Production

- 26. Copper
- 29. Interview with MMG Las Bambas
- 30. Interview with Hudbay Minerals
- 32. Interview with Southern Peaks Mining
- 33 Gold
- 35. Interview with Barrick
- 36. Interview with Gold Fields
- 37. Interview with Buenaventura
- 40. Silver
- 42. Interview with Hochschild Mining
- 43. Interview with Great Panther Silver
- 44. Zinc
- 45. Interview with Nexa Resources
- 46. Other Base Metals
- 47. Interview with Shouxin
- 48. Map: Peru's Main Mines

Juniors Gain Momentum

- 52. The Gold Production Solution
- 53. Interview with PPX Mining
- 54. Interview with Lupaka Gold
- 54. Interview with Eloro Resources
- 55. Copper Excitement
- 56. Interview with Kaizen Discovery
- 56. Interview with Chakana Copper
- 57. Interview with Regulus Resources
- 60. Zinc Exploration
- 60. Interview with Tinka Resources 62. Grassroots is Back
- 63. Interview with Pucara Resources
- 63. Interview with Palamina
- 64. Interview with Condor Resources
- 65. Interview with Miramont Resources
- 66. Uranium and Lithium
- 67. Interview with Plateau Energy Metals
- 68. Fertilizers
- 68. Interview with GrowMax Resources

Engineering and Construction

- 72. Sharpening up Projects
- 73. Interview with SNC-Lavalin
- 74. Interview with Ausenco
- 75. Interview with Anddes
- 77. Interview with SRK
- 77. Interview with Mining Plus
- 78. Interview with Hatch
- 78. Interview with BISA
- 79. Water and the Environment
- 80. Interview with Golder
- 80. Interview with Klohn Crippen Berger
- 81. Interview with Amphos21
- 82. Insights: Consultants Have their Say
- 84. Contractors-in-Waiting
- 85. Interview with OHL

- 86. Interview with STRACON
- 88. Interview with Pevoex
- 89. A Level-Playing Field
- 90. Interview with Grupo Vivargo
- 91. Interview with Kaefer Kostec
- 91. Interview with Imecon
- 92. The Socavón Opportunity
- 93. Interview with AESA
- 94. Interview with Mas Errazuriz
- 94. Interview with IRC
- 95. Interview with Byrnecut Offshore
- 98. Interview with Tumi Raise Boring
- 99. Interview with Master Drilling
- 99. Interview with Montali
- 101. Interview with Robocon

Equipment and Technology

- 104. The Future of Mining
- 106. Interview with Komatsu
- 108. Interview with Ferreyros
- 109. Interview with Epiroc
- 110. Interview with IPESA
- 111. Construction and Ancillary Equipment
- 112. Interview with Divernotor
- 112. Interview with Scania
- 112. Interview with Volvo
- 114. Interview with Sullair
- 115. Equipment Components
- 116. Interview with Bosch Rexroth
- 116. Interview with Austin
- 117. Interview with FUCSA
- 118. Underground Equipment
- 119. Interview with Resemin
- 121. Interview with Normet
- 122. Interview with Boyles Bros Diamantina
- 122. Interview with Core Tech
- 122. Interview with Technosteel
- 123. Comminution and Material Handling
- 124. Interview with FLSmidth
- 125. Interview with Metso
- 126. Interview with Thyssenkrupp Industrial Solutions
- 126. Interview with Weir Minerals
- 128. Interview with Andritz
- 129. Productivity Technologies and Automation
- 130. Interview with Siemens
- 130. Interview with Yokogawa
- 131. Interview with Sitech

Service Providers

- 134. Drilling Services
- 136. Interview with AK Drilling International
- 137. Interview with Geotec
- 137. Interview with Explomin
- 138. New Blasting Technologies
- 139. Interview with Exsa 140. Interview with Orica
- 140. Interview with Maxam 141. Efficiency and Environmental Solutions
- 142. Interview with Certimin
- 142. Interview with Bureau Veritas 143. Interview with CyanoGuard
- 144. Interview with Ouimtia
- 145. Interview with Ixom
- 146. Outsourcing
- 147. Interview with Avis 147. Interview with SK Rental
- 147. Interview with Arval Relsa
- 148. Interview with Sodexo
- 148. Interview with Hermes
- 149. Mining Safety and Risk Control 150. Interview with Rimac Seguros
- 150. Interview with Willis Towers Watson
- 152. Company Directory 158. Credits







Introduction to Peru

GBR analyses the latest political changes and Peru's positioning as a market open for investment

6-23

Mining Production

An overview of the main mining producers including interviews with MMG, Hudbay, Barrick, Buenaventura, Nexa and others

24-49

Exploration is Back

Our A to 2 guide to the most important juniors with active projects in the country

50-69

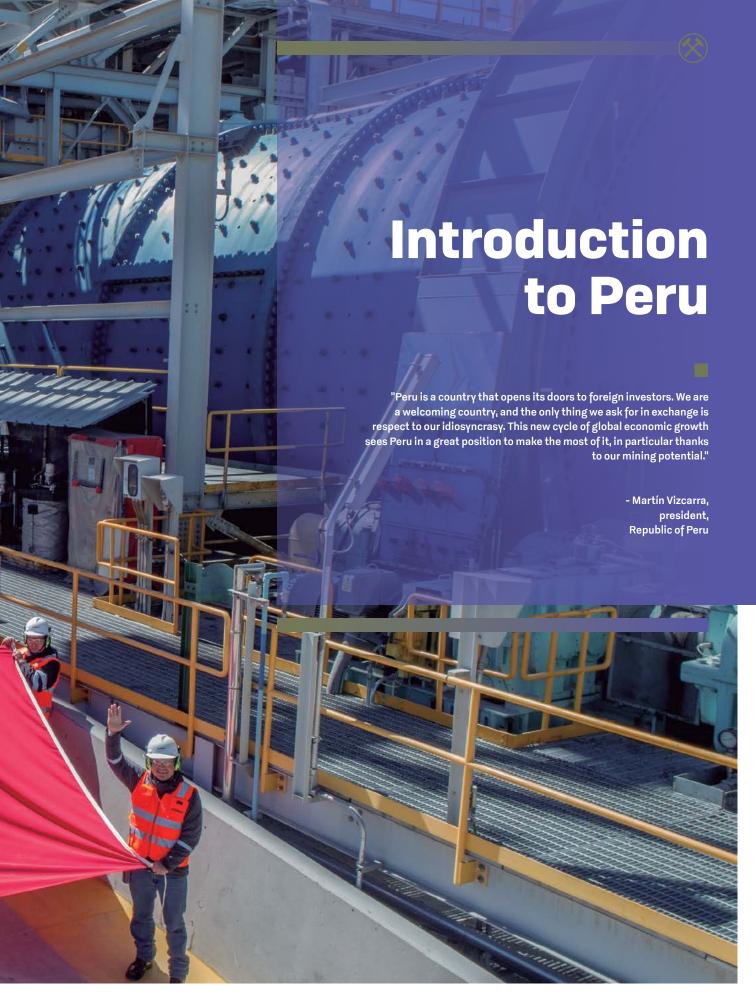
Equipment, Technology and Services

Discover Peru's world-class players across the full value chain, from engineering to mine closure

70-151







A New Government for a New Mining Cycle

The Vizcarra administration must prove that more mining projects can be developed under its watch

The last months of Pedro Pablo Kuczynski's tenure as president of Peru were nothing but turbulent. When he narrowly avoided impeachment on December 21st, 2017, one could have thought that the stars aligned to save him on that summer solstice. However, when just three days later he allowed the release of former president Alberto Fujimori, who had spent over a decade in prison, the public figured out the nature of the agreement that Kuczynski, also known as PPK, had forged with Alberto Fujimori's son, congressman Kenji Fujimori.

The efforts for a new start in 2018 were in vain. PPK's new cabinet, sworn in in January, barely lasted two months. On March 21st, one day after the autumnal equinox, the stars were far from aligned in PPK's interests. A series of revelations about murky political agreements and Kuczynski's private finances added to the already known links of PPK with Brazilian construction firm Odebrecht. Just one day before a second impeachment vote was to be held in Congress, Kuczynski resigned as president.

PERU AT A GLANCE

Source: IMF, 2017 data

Capital city: Lima GDP: US\$215.2 billion GDP Growth: 2.51%

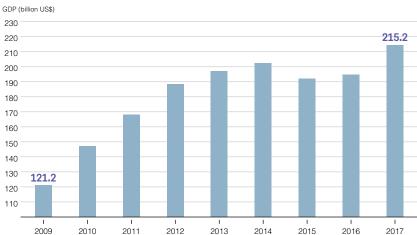
Head of State: President Martín A. Vizcarra (since March 2018)

Current account balance (% of GDP):-1.26%

Inflation rate: 2.8%

GDP EVOLUTION IN US DOLLAR VALUE

Source. livir



8

DEMOGRAPHIC DATA

Sources: IMF, INEI

POPULATION 31.8 MILLION



POVERTY RATE 21.7%

UNEMPLOYMENT RATE 6.71%

GDP per capita

US\$6,762

GDP per capita (PPP)

US\$13,334

Interestingly enough, in parallel to all this the mining industry continued its recovery path, with solid commodity prices helping companies across the board reduce their debts and move their feasibility-stage projects towards a construction decision. Indeed, after three consecutive years of decline, total mining investment in Peru increased by 15.7% and reached US\$4.92 billion in 2017. For 2018, the government expects an additional 20% growth.

When Martín Vizcarra took over as head of state, the sector not only welcomed the end of PPK's political agony, but also the new president's proactive approach towards mining development, following his successful work with Anglo American at the Quellaveco project when he was governor of the Moquegua region, between 2011 and 2014.

Luis Marchese, Anglo American's country manager, is the person who worked hand in hand with Martín Vizcarra during that process. Speaking as president of the SNMPE, the mining industry's main association, Marchese gave his impressions about Vizcarra's new cabinet: "This gov-



Rising to each new challenge is what we do. When we celebrate our success together, we gain the strength to go further.

Together, we build the future.



ernment is more pro-decentralization than the previous one. Both the new president and the new prime minister are former regional governors, which should help give impulse to the mining activity, considering

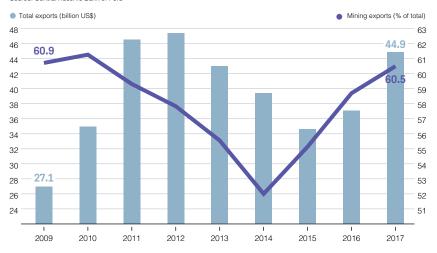
that mining is a decentralized industry."

Marchese further elaborated on this: "I have always believed that the main obstacle for the development of new mining projects was not the Ministry of Energy and Mines but the regional governments and local authorities. I have the feeling that this new government will be more familiarized with that dynamic: regional governments have to be much more proactive to promote mining activity."

Víctor Gobitz, CEO of Buenaventura, declared that the political transition was "abrupt, but acceptable, because it followed the existing legal framework." He also shared his opinion about the new president: "Martín Vizcarra may not have the same macroeconomic experience that Pedro Pablo Kuczynski had, but he has more experience at the micro level, overseeing the relationships between the mining companies and the communities. This can actually be very helpful, because what delays projects is not so much permitting or bureaucracy, but the inability to sign fair, long-lasting agreements with the communities. Quellaveco is a success case that should not be underestimated," he concluded. ■

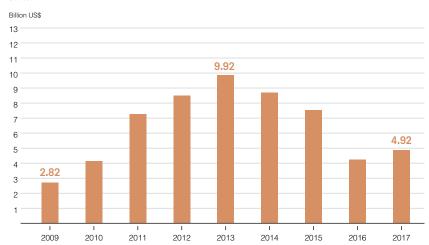
ANNUAL EXPORTS BY VALUE

Source: Central Reserve Bank of Peru



TOTAL MINING INVESTMENT IN PERU

Source: MEM







Martín Vizcarra

President
REPUBLIC OF PERU



The dialogue table of Quellaveco has been a model for consensus building that needs to be replicated in other projects. Once Quellaveco starts production, it is going to be a very important project for Peru's economy, and even more important for a small region like Moquegua.



How can Peru establish the right conditions for the development of its mining project portfolio?

Over the last years, we have learnt that we need to find the right balance between economic activities, respect for the environment and an adequate relationship with the local populations. That balance cannot be achieved through a supreme decree; you can only get there through hard work and dialogue. In Peru, we already have several examples with very good results that serve as a model for project development. We also have projects trapped in difficulties because they have not been handled in the right manner by either the mining operator or the State itself. Therefore, we need to embark on a continuous improvement process.

As previous governor of Moquegua, what were the lessons learnt from the dialogue table for the development of Ouellaveco?

The dialogue table of Quellaveco has been a model for consensus building that needs to be replicated in other projects. Once Quellaveco starts production, it is going to be a very important project for Peru's economy, and even more important for a small region like Moquegua. There, a new challenge arises: the regional and local authorities need to be prepared to manage the tax money generated by the project. Those funds should not be used to build irrelevant infrastructure, but to substantially improve the lives of all Moqueguans. In the past, the money from the mining taxes has often been used to build large monuments or white elephants that do not bring progress for the population.

Critics blamed decentralization for these past mistakes. Do you think Peru should continue the decentralization process?

I am an advocate for decentralization. All decisions should be made closer to the populations that are going to be affected by them. During the decentralization process, we have had good examples and bad examples. Those who defend a return to centralization only highlight the bad examples. Decentralization has its challenges, but the solution is not to go back to centralism. We need to strengthen the

regional structure, identify and correct the problems. Also, we need the population to be educated, empowered and vigilant, to ensure that their authorities use their resources properly.

Mining typically happens in remote areas. What is the role of the State in promoting the relevant infrastructure projects?

My view is that large projects such as rail-way investments to support mining operations should be mixed investments between the public and the private sectors. The private sector should contribute with the right percentage, according to the use that they are going to make of any particular infrastructure. There are some rail projects that are for social use for the whole community, and those should be fully funded and executed by the State. However, when you have a project that goes directly to a particular mine, that is a private project.

ProInversión recently awarded the Michiquillay project. Do you think Southern Copper will be able to solve the community issues there, as well as in Tía María?

Michiquillay was awarded in February, and the level of participation shows the great interest that mining investors have in Peru. The advice we can give from the State is that the operator should engage in an empathic relationship with the communities. We certainly hope that any challenges will be overcome and that the project will be brought into production. With regard to Tía María, the project still presents some issues inherited from previous years, so it may take a bit longer, but with the right approach from the different parties, I am sure that any issues can be solved.

What is your message to investors that want to develop mining projects in Peru?

Peru offers enormous mineral wealth, and it is a country that opens its doors to foreign investors. We are a welcoming country, and the only thing we ask for in exchange is respect to our idiosyncrasy. I am very optimistic because this new cycle of global economic growth sees Peru in a great position to make the most of it, in particular thanks to our mining potential.



Luis Marchese

President

NATIONAL SOCIETY OF MINING, PETROLEUM AND **ENERGY (SNMPE)**

The fix cost of infrastructure in Peru is higher than in other countries. Ideally, most of the capex should go to the mine, the plant and some ancillary facilities, but if you need to build the road and the port the capex starts to increase. This can make some projects unviable.



What is your opinion of the new government established in April 2018?

This government is more pro-decentralization than the previous one. Both the new president and the new prime minister are former regional governors, which should help give impulse to the mining activity, considering that mining is a decentralized industry. Also, the new minister of Energy and Mines has a mining background. I know the new president well from his tenure as regional governor of Moquegua. He has been quite pragmatic and has had a regionalist approach, but in the right way, always taking care of the development opportunities for his region.

I have always believed that the main obstacle for the development of new mining projects was not the Ministry of Energy and Mines but the limited involvement of the regional governments and local authorities. I have the feeling that this new government will be more familiarized with that dynamic: regional governments must be much more proactive to promote mining activity.

In this context, what do you expect of the upcoming regional elections?

At the SNMPE we want to make some political agenda contributions for the upcoming regional elections. For instance, we are doing a study about the mining canon, which has been in place for more than 15 years already. We want to analyze the level of funds that the mining canon has brought to some of the mining regions, and how these funds have been used. Those monies should be efficiently used for the benefit of the people - our findings might help to do that.

What could the industry do to raise awareness about mining in the country?

There is a lot of data from mining companies that is not shared with the general public. In the consolidated annual statements from companies, we provide up to 175 data variables. The Ministry of Energy and Mines only uses four or five of them for their reporting. If that data was packaged more thoroughly, there would be so much more information about the mining industry that could be shared, and that would be great for transparency.

Does the SNMPE anticipate higher levels of mining investment this year?

It is difficult to predict the exact figure, but I personally believe mining investment should certainly increase this year, for several reasons. To start with, higher levels of cash-flow are allowing companies to invest in their processes, so all the projects that were discretionary are being implemented now. Companies are addressing their bottlenecks to increase production, exploration is also increasing, and then you have the new greenfield developments, like Quellaveco, Mina Justa, Pampa de Pongo and others.

How can Peru address its infrastructure deficit?

The fix cost of infrastructure in Peru is higher than in other countries. Ideally, most of the capex should go to the mine, the plant and some ancillary facilities, but if you need to build the road and the port the capex starts to increase. This can make some projects unviable. Ideally, the infrastructure should be developed, so those projects that are marginal today can become economic.

What is the SNMPE's view of the basin headwaters legislation?

We did a study of around 15 countries, and none of them has specific legislation on basin headwaters or initiatives to make these intangible. What Congress asked ANA is very difficult; it is basically to create the concept of what basin headwaters is, and also to develop the regulation to handle this new concept. This is leaving space for creativity, and you need to be careful when you promote creative exercises.

Do you expect mining companies to work together to develop the large deposits in Cajamarca?

In Cajamarca you have three deposits in the same area: Michiquillay, Conga and Galeno, and I am sure that all the companies there want to collaborate, but the problem there is political. What is needed is a State strategy for the region, because Cajamarca has a stigma of being a difficult region. The fact that there were different companies interested in Michiquillay shows that there is interest from investors. This stigma should be overcome by the right public policy.

Pushing the Project Pipeline

A quick look at the most immediate mining development potential

Before the political crisis, the Ministry of Energy and Mines, now led by former mining executive Francisco Ísmodes, defined five key objectives for 2018. These include making feasible the existing pipeline of projects, some of which have been pending for many years now. Speculation surrounding key potential investments continues to grow: with Quellaveco already on the go, there is expectation that projects like Mina Justa, Pampa de Pongo and Corani will begin construction soon.

Even before the official construction decision for Quellaveco was announced, Anglo American already had around 3,000 people in the area doing substantial early works, such as the diversion of the Asana river. The sale of an additional 21.9% stake to Japanese partner Mitsubishi for US\$600 million was a key milestone towards further de-risking the project. Meanwhile, Minsur made a significant step towards the financing of its US\$1.6 billion Mina Justa copper project by selling 40% of the asset to Chile's Alxar Inversiones (part of the Angelini Group) for US\$200 million. Finally Chinalco, who had a very challenging

ramp-up at Toromocho over the last years, also announced that a US\$1.3 billion expansion at the copper mine in central Peru is already under way.

EDITORIAL .

In parallel to that, some triggers are yet to be pulled. As an example, Anthony Hawkshaw, president and CEO of Bear Creek Mining, remained cautious regarding Corani's potential construction schedule: "There is only one chance to build a project correctly. It is wiser to spend additional time and investment now on engineering than to rush ahead. We are being deliberate, thorough, and patient to minimize potential risks."

Corani, one of the largest undeveloped silver deposits in the world, has a significant zinc content. With the zinc price having reached an 11-year high, one would assume there would be pressure to act. However, the project requires a capital expenditure of US\$585 million, a large amount for a junior company, and Hawkshaw and Bear Creek's shareholders have seen a lot of failures over the years arise from rushing into construction. The company is therefore waiting for the right financing conditions.



Industry Explorations PERU MINING 2018

NTERVIEW Global Business Reports



Juan Luis Kruger

CEO MINSUR

We feel that the engineering risk is lower at Mina Justa than at any other project at this stage of development. It is a world-class ore body with very low execution risk thanks to its location in prime mining real estate, just next to the Pan American highway and close to the sea and power infrastructure.

What have been the latest milestones in the evolution of Mina Justa?

The feasibility study was approved by our board a few months ago. While this was a key milestone for us, this is around a US\$1.6 billion project, so we decided to implement a two-tier financing strategy. First, we decided to bring in an equity partner. We ran a very competitive process, and The Angelini Group of Chile, through Alxar Investments, acquired 40% of Mina Justa. Secondly, we are in the process of closing our debt portion of the project for between US\$800 million and US\$900 million, divided between export credit agencies and commercial banks.

In parallel to the financing process, the project has not stopped moving. Could you provide more details?

Last year we decided to do some early works (roads, camps, explosive magazines, fuel stations, power transmission lines) and lock in the price and delivery times of the critical equipment. The idea is that, by the time we secure the full financing for the project, we can shorten the time to market. Meanwhile, we have been working on the detailed engineering and today, we have 70% of it completed to reduce the execution risk.

We feel that the engineering risk is lower at Mina Justa than at any other project at this stage of development. It is a world-class ore body with very low execution risk thanks to its location in prime mining real estate, just next to the Pan American highway and close to the sea and power infrastructure. It is also going to be a sustainable project that will only use seawater for its process, and there is a wind farm being built right next to the project.

How important is it for Minsur to have joined the International Council of Mining and Metals (ICMM)?

Joining the ICMM showcases our commitment to sustainability in all of our operations. This is another milestone of a long journey that started many years ago. We went through a rigorous and exhaustive process to join an institution that includes the world's largest and most important companies. We are the first Peruvian company and the only tin company worldwide to join the organization.

Speaking of your tin business, could you tell us about the B2 project at San Rafael and the Nazareth deposit?

The B2 project, a US\$200 to US\$220 million investment, is under construction right now and should be commissioned by Q3 2019. This is an important project for us, that will add 5,000 mt/y of refined tin at a very high margin. From an environmental perspective, we are retreating old tailings, so we are going to be creating value by improving our environmental performance. From an operational perspective, the new plant is located right next to the tailings dam, so it will be very efficient. Overall, B2 will increase our production profile by 20% to 30% through 2028 or 2029. This is probably the largest capital investment in a new tin project worldwide for the last 15 or 20 years.

Regarding Nazareth, we are working on scoping studies. It is a new ore body we have found right next to the main San Rafael vein, which should come into production in 2024 or 2025. So far, we have expanded our resources at Nazareth to 150,000 mt of contained tin, and the deposit is still open at depth.

Finally, you have a high-margin gold operation, Pucamarca. How is that mine performing?

Pucamarca was a greenfield project that we built in 2013, and since then it has really become a very significant contributor to our company's results. It is a world-class gold mine and is a really low-cost operation at less than US\$350 per ounce. We started Pucamarca at 14,500 mt/d, and we ramped it up with very little capex to 21,000 mt/d. When we started, we thought we had a mine-life of seven years at a much lower capacity. Through a lot of exploration work and optimization, we have extended mine-life and as of today we still have seven years to go.

PERU MINING 2018

Anthony Hawkshaw & Elsiario Antúnez de Mayolo

AH: President and CEO
EAM: COO and General Manager
BEAR CREEK MINING
CORPORATION





Can you summarize the Corani project's latest developments?

EAM: Since last year, the main engineering changes were based on the use of contract mining equipment. We reduced the capex to US\$585 million and increased the opex. In general, the reserves are the same and there have been some changes to our long-term pricing assumptions, now sitting at US\$18/oz silver and US\$1.10/lb zinc. The payback is currently three years, although with the current spot prices it would be shorter than that.

AH: The engineering firm involved identified certain areas that we could focus on to improve metallurgical recoveries. The early results of a new testing program are encouraging and may have the effect of reducing the capital cost in treatment and processing. We are going to carry out more geotechnical and metallurgical tests and are entering discussions with engineering firms to start on detailed engineering. There are areas to save money and initial engineering observations have identified possible capex reductions. In regards to project financing, we are talking to international lending agencies and private equity firms to see what package we can put together.

With record-high zinc prices and constant speculation as to when Corani will start construction, what is the project's current timeframe?

AH: We have to be patient as there is only one chance to build a project correctly. It is wiser to spend additional time and investment now on engineering than to rush ahead. We are being very deliberate, thorough, and patient to minimize potential risks. In addition, many systems and procedures must be designed—from health and safety programs, training, maintenance, and even lightning detection equipment. When I was a lecturer, I used to tell my students, think first, write later. You can process much more when you are thinking rather than when acting and I believe this is the right approach for us.

With respect to the rising zinc price, our investors' feedback is to keep doing what we have been doing. Our larger shareholders are sophisticated long-term mining investors that have had a lot of success and some failures in their time. Some of those

failures came from companies rushing into construction.

With an anticipated capacity of 22,500 mt/d, do you think the market understands that Corani is not the typical Peru underground silver project?

AH: It is large for a silver project, but when you compare it to a lot of open pit copper projects, it is very small. It might be a little more complicated, as it is a silver-lead-zinc mine. The footprint may not be huge, but it is still a US\$500-US\$600 million project with an expected 2,500 people working on its construction. A slow, deliberate and intelligent process will be undertaken to protect our shareholders and the local communities, and the market will eventually reward the company for this.

Can you tell us about the work Bear Creek has been doing with the local communities of Chacaconiza and Quelcaya?

EAM: We have been developing skills and business ideas within the community to create long-term benefits. Mines are always temporary and cannot support the community forever, so it is important to guarantee the long-term future of the local populations. In the past five years, the economy in the area has improved tenfold with social entrepreneurship, including alpaca wool projects, and other schemes driving this growth. The community is feeling the effect of the improved economy and the benefits of our presence. We are also helping to connect community leaders and the central government, as it is usually difficult for the local people due to the remoteness of many of their communi-

What will be the main milestones for Bear Creek this year?

AH: The main milestones for 2018 will include completing more engineering, continue testing and raise funding depending on market conditions. Furthermore, we will commence a limited program of early infrastructure work at the mine with the establishment of a camp and the construction of local roads. We will also continue helping the communities outside the project area with a reliable source of electricity, in a process that began in January.

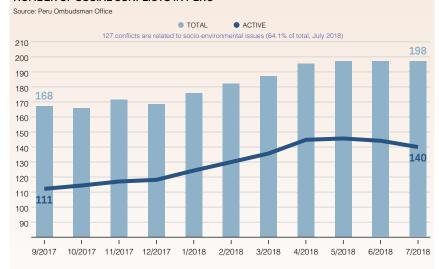
The Social Aspect of Mining

As investment increases, the industry must work proactively with the wider society

Peru is conducting regional and municipal elections on October 7th, 2018, and once again, mining is on the agenda. While the changing of authorities may produce added hurdles in terms of bureaucracy and relationships, the sector has been generally positive on the potential outcomes of the ballot. Indeed, many believe that there has been a change in how communities and politicians perceive the mining industry, especially in regions where anti-mining sentiment has been high. Phil Dalke, until recently vicepresident and managing director of Tahoe Peru, said: "Our relationship with our communities can change depending on the different dynamics, however we strive to make our communities partners in our sustainability projects. We sense that many of our communities want more mining activity."

To ensure new mining projects can be developed in Peru, mining companies have adapted their engagement with the local populations and many are now doing more to build closer ties. Elsiario Antúnez de Mayolo, COO and general manager at Bear Creek, has made community relations a priority for the Corani project. "We have been developing skills and business ideas within the community to create long-term benefits. Mines are always temporary and cannot support the community forever, so it is important to guarantee the long-term future of the local populations," he said.

NUMBER OF SOCIAL CONFLICTS IN PERU



SOCIO-ENVIRONMENTAL CONFLICTS PER INDUSTRY (JULY 2018)

of conflicts Minina 84 66.1% Oil and Gas 17 13.4% Energy 7.1% Waste and Sanitation 5 3.9% Agro-industry 2 4% Forestry 2 1.6% Other 7 5.5%

Meanwhile Luis Rivera, executive VP Americas at Gold Fields, the company running the Cerro Corona mine, declared: "We are used to working in Cajamarca. It is not the easiest environment, but since we started there has not been much opposition. We hope that, with the election, the political side of things will be more favorable to mining moving forward."

Source: Peru Ombudsman Office

Jorge León Benavides, leader of the past Peru delegation to PDAC at the Canada Peru Chamber of Commerce, shared similar hopes with regard to the upcoming election, particularly in Cajamarca: "In Cajamarca, communities were told that they would receive support for agricultural development, but seven years after the suspension of Conga, that region continues to be one of the poorest areas in the country. Now, many people want mining investment to be back. The regional governor is an anti-mining and anti-establishment activist, so whoever replaces him should bring positive change." GDP growth in 2017 was only 2.5%, an insufficient figure for a country on its way to further development. Mining will continue to be the key driver of Peru's economy, and taking advantage of the high metal prices will be key to building momentum and unlocking a new wave of mining investment. As has been the case in the last two decades, mining projects may prove to be a significant catalyst for Peru to climb the ladder of economic development.



Namrata Thapar

Global Head, Mining
INTERNATIONAL FINANCE
CORPORATION (IFC)



In Peru the IFC has invested in projects such as Yanacocha, Quellaveco, Haquira, and more recently with Tinka Resources in the Ayawilca property. In both Yanacocha and Quellaveco the partnership lasted for almost 20 years.

What is the support the IFC offers the global mining industry?

The IFC, a member of the World Bank Group, invests in the private sector in order to help emerging markets grow. The IFC currently has US\$55 billion as committed portfolio, with about US\$650 million dedicated to mining. Profitability with sustainable development is our mandate – we look at projects that are financially viable but also make an impact on the ground in a regional and country context.

The mining sector is key for many Latin American countries, rich in mineral geology. In the 1980s, the IFC invested in Escondida in Chile, and entered Peru in the mid-1990s with Anglo American and Quellaveco through equity risk capital. We tend to be long-term partners, whether via equity, debt participation, or anything in between. Alongside financial investment, the IFC has also pioneered sustainable advisory services – working with local governments and communities to make mining more beneficial, sustainable and responsible.

How does the IFC select the projects and companies it invests in?

As a profit institution with our own balance sheet, a project must be financially viable so that we can re-use our capital to help boost global development. The IFC looks for mining projects that will generate long-term, sustainable revenues for a country and help the development of the region. We are present at international mining events, and have a large network of commercial banks and multi-laterals that we work closely with, especially on large-scale projects where one party cannot deliver the whole solution alone. In many developed mining jurisdictions there is liquidity in the market and companies often prefer working with commercial banks for short-term, capital debt financing. The IFC has a long-term outlook – promoting the longevity of mines and training local communities to build on regional supply chains.

What presence does the IFC have in Peru?

Our office in Peru looks at all business sectors, but the natural resources space is of particular focus. The office keeps abreast of business trends in Peru and the status of upcoming mining and exploration projects. In Peru the IFC has invested in projects such as Yanacocha, Quellaveco, Haquira, and more recently with Tinka Resources in the Ayawilca property. In both Yanacocha and Quellaveco the partnership lasted for almost 20 years.

Can you elaborate on the work of the IFC and the Canadian government in Apurimac?

The Apurimac Revenue Management Project is structured with two complementary delivery mechanisms. Firstly, we work closely with the local government and community leaders to improve the mining revenue system – in undeveloped mining jurisdictions there is often good intent, but the regional population does not know how to make the most of the revenue a mine generates. Secondly, we promote better agricultural practices that support small scale farmers. Our work in this region revolves around sales training, investments, building peer to peer capacity through community dialogue with leaders, providing micro irrigation systems, greenhouses, breeding environments for guinea pigs, and the identification of markets that farmers can tap into in a strategic manner.

How can you ensure institutional development in regions that rarely see its benefit?



Stakeholder engagement right from the beginning is fundamental. Sometimes the management of expectations is not taken into account, and companies may have a timeline that locals are not always fully aware of. The IFC requires a commitment from its clients that they will adhere to IFC's environmental and social standards, publish their revenues, payment of royalties, taxes, and funding of local economic development plans, so everybody is aware of what is being generated from a mine.

Open for Business

Peru's bureaucracy can be cumbersome, but the country is a safe investment destination

Peru's continued economic growth since the 1990s would not have been possible without the promotion of investment across different sectors of the economy and the development of a legal framework attractive to private capital, Peruvian and foreign alike. The growth curve had its woes, too, and when growth cooled down during the last mining downturn, many blamed the multiplicity of regulations that made permitting a long and expensive process for project developers.

"From a regulatory standpoint, the permitting aspects continue to be critical," said Carlos Guzmán, partner at Ontier, a law firm. "While Senace, the body in charge of environmental impact assessments, has changed drastically for the better the service that companies receive from the State, the State is much bigger than Senace, and not all entities work in the same manner. The water authority (ANA) and the forestry authority (SERFOR), to give some examples, are not up to the speed that these permitting processes require."

Carla Martínez, general manager of the Canada-Peru Chamber of Commerce, cited data from the World Economic Forum to highlight that bureaucracy, lack of infrastructure and rigid labor laws are among Peru's main obstacles for investment. "Particularly in mining," she added, "the main issue is the lack of the right mechanisms to

establish a dialogue with the communities in the area of influence of projects."

While the social issues require a case-bycase approach, looking at the big picture, Peru should still be seen as a solid destination to undertake mining projects. Indeed, the last political crisis involving PPK's resignation has not derailed the main investments that were in the pipeline for this year, including Toromocho's expansion, Quellaveco and Mina Justa. According to Fernando Pickmann, partner at Dentons and COO of Regulus Resources: "Martín Vizcarra successfully managed to gather around the same table all the stakeholders in Quellaveco. I think the new government opens up a brilliant opportunity to really unlock mining projects that were trapped due to a lack of good management skills." According to the 2017 Fraser Institute Survey of Mining Companies, Peru ranked as the 19th most attractive jurisdiction for mining investment. With the exception of Chile (8th), all the other jurisdictions that outperformed Peru were in Canada, USA, Australia or the European Union. Anglo American's recent commitment to deploy over US\$5 billion on Quellaveco, with its CEO Mark Cutifani stating that the asset could be in production for more than 40 or even 60 years, shows that investors continue to see Peru as a key country for present and future mining projects.

From a regulatory standpoint, the permitting aspects continue to be critical. While Senace has changed drastically for the better, not all entities work in the same manner. The water authority (ANA) and the forestry authority (SERFOR), for example, are not up to the speed that these permitting processes require.

- Carlos Guzmán, partner, Ontier Perú



Peru's geological upside is undeniable, especially in terms of copper, but other countries have a fantastic geology and have failed to developed their mining industries to a fraction of their real potential, like Argentina. Thus, despite all their faults, the successive administrations in Peru over the last couple of decades must have done something right.

"Of Latin America's five largest countries, not only has Peru had the best average growth rate since the start of the decade — Peru has also been the country with the lowest inflation rate," affirmed Martínez of the Canada-Peru Chamber of Commerce. "It is the good macroeconomic management that has allowed our country to mitigate the negative impact of several economic shocks, some of which have affected the whole region over the last years."

Carla Martínez

General Manager

CANADA-PERU CHAMBER

OF COMMERCE



How important is Canadian investment for Peru's mining industry?

Peru is a strategic partner of Canada. According to the Canadian government, by the end of 2017, the stock of direct Canadian investment in Peru amounted to C\$11.1 billion. This placed Peru as the third recipient of Canadian investment in Central and South America, and the 14th worldwide. Within that, the mining industry is one of the most important sectors for Canada in Peru, the others being oil and gas and financial services. In mining, there are eight Canadian companies with 10 operating mines in Peru, of a total of 60 companies with projects at different stages. According to the Ministry of Energy and Mines, out of 11 countries active in exploration, Canada is the largest investor, with US\$72 million or 23% of the total expected investment. Beyond this, there is a Canadian cluster in Peru with more than 100 technology and service providers for the mining sector.

What education initiatives related to mining is Canada promoting?

As part of Canada's Regional Program of Education for Employment in the Pacific Alliance, funded with C\$16 million, the Hono-

rio Delgado Espinoza Institute in Arequipa is developing skills for employment in the mining sector. This is centered on metallurgy and heavy equipment maintenance, in collaboration with a consortium of Canadian institutions.

Meanwhile, the Canada-Peru Chamber of Commerce launched its *Mujeres Roca* initiative in 2016, in partnership with OMA and inspired by Canada's 'Women Who Rock' program. In Peru it is aimed at women aged between 23 and 28, who are in their final stages of mining-related university programs or who have a proven interest in the industry. Every year, we select the 10 best candidates country-wide.

How well positioned is Peru to attract more investment?

Peru maintains solid economic fundamentals. Of Latin America's five largest countries, not only has Peru had the best average growth rate since the start of the decade – it has also had the lowest inflation rate. It is the good macroeconomic management that has allowed our country to mitigate the negative impact of several economic shocks, some of which have affected the whole region over the last years.

Fernando Pickmann

Partner **DENTONS**



How did Gallo Barrios Pickmann decide to join forces with Dentons?

The business went very well for us at Gallo Barrios Pickmann, but we reached the stage where we had to grow to access the next tier of the market. What attracted us to Dentons was that it really allowed us to be part of a global firm. Now, we are very well prepared to continue serving our mining clients. My experience with junior companies allows me to understand the business aspects of mining, and in Canada we have one of the best mining lawyers, Brian Abraham, who is also a geologist.

What should be improved in Peru's legal framework?

The new exploration regulation simplifies processes and makes drilling easier. However, companies still complain about the final permit to start operations. For the State, this is just a safeguard to make sure that companies have all the permits in place, and can be seen as reasonable. The prior consultation process with indigenous communities, however, has been distorted, because the communities have been empowered to block projects and this should not be the case.

How is the junior market evolving?

The improvement of mineral prices is leading to increasing share prices. If the trend continues, that will open up investment opportunities and boost exploration. There are private companies looking for projects, and also private companies with projects that are thinking of going public. So, the wheel is starting to turn, and companies listed in Canada are thinking of listing in Lima as well. Last year, Peru completed its tax amnesty for the repatriation of capital, so there is a lot of money in Peru waiting for new investment vehicles.

Should the government lift the ban on foreign investment near the border?

The best defense that the country could have to protect its borders is to have live investments. The only way you can invest is if you have a land title, but foreign companies or investors cannot work on properties within 50 km of the border. This is a constitutional norm and so far no-one has had the courage to lift this ban. Sadly, I do not think this will change in the short term and the country is losing significant mining potential. All the border with Ecuador is very prospective, and there are also very good projects in the south.

Industry Explorations PERU MINING 2018

The Battle for Talent

More projects and investment means stronger competition for people

While the industry is much more disciplined than during the boom years, the hunt for talent to take care of the new mining projects – for construction first, and then for the operation – will inevitably shake the human resources market in Peru. Headhunters that we surveyed acknowledged that the market has already heated up: "In 2017, we could see a 35% increase in searches, divided equally between operations and projects," said Diana Rake, partner at Transearch.

She added that, after the political turmoil in Peru earlier this year, the market is reactivating again with the start of the second semester. In any case, said Rake, the industry is not limited to Peru's boundaries in its search for new professionals: "Competition always helps to raise salary expectations but [...] there are not so many projects in South America or the world, and there are people willing and able to come to Peru." The evolving nature of mining projects and operations, with an increased focus on safety, digitalization, automation and the use of Big Data, means that managers need to be familiar with the latest technologies in order to make the most of them and increase efficiency to the maximum. Nowadays, if it is difficult to find the technical

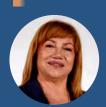
'gurus', it is even more difficult to find the people who will be their managers. Alberto Calle, partner at Korn Ferry, developed on this issue: "As new large mining discoveries become more scarce, have more complex metallurgical conditions or are in more remote locations, [...] the search to optimize processes is a permanent topic on the CEOs' agenda. It is in this context that the approach towards technological solutions for remote control of mobile equipment, interconnectivity of processes, and detection of fatigue symptoms, among others, must be on the radar and knowledge of mining professionals."

UNVEILING MINING OPPORTUNITIES WITHIN THE 'BIG FOUR' AGENDA: KENYA NAVIGATING THE PACE!



20

The Role of Women in Peru's Mining Industry



Lita Calenzani, President, Women in Mining Peru (WiM Peru)

Mining is a strategic industry for Peru, contributing around 10% of GDP and employing nearly 200,000 people in 2017. Yet, the participation of women in the sector is limited and only reaches 5.4% of the total mining industry workforce according to the Ministry of Energy and Mines. Looking more closely at these figures, 49% of women are dedicated to administrative positions; 30% are in general operations; 17% work as plant personnel and only 4% hold management positions.

It is therefore urgent to increment not only the overall female participation, but also the share of women working at the plants and at the management layers of the industry. The World Economic Forum, in its Global Gender Gap Report for 2017 that gathered data from 144 countries, reflects this worrying situation, stating that the gap between male and female workers will only disappear in 217 years time (so, in 2234). Peru ranks 128th out of 144 countries, so we would be talking of centuries before we see the elimination of the salary gap.

During the last Perumin - 33rd Mining Convention, David Brereton of the University of Queensland presented a study that unveiled the low participation of women in Peru's mining industry, as well as a negative trend to

It is urgent to increment not only the overall female participation, but also the share of women at the plants and at the management layers of the industry. keep things that way or even reduce female participation.

Beyond the search for social justice, a number of international studies are proving that gender diversity directly contributes to the companies' profitability. The aforementioned World Economic Forum's report suggests that gender economic parity could add US\$250 billion to the GDP of the U.S.A., and US\$2.5 trillion to the GDP of China. Thus, investing in equality is profitable, and the world's GDP could take advantage of that, experiencing 26% growth by 2025.

The promotion of a wider participation of women in the industry is a duty of the State, the companies and the civil society. The State needs to implement public policies that promote parity and equal opportunities. Companies need to review their corporate policies regarding recruitment and career path development. Finally, the civil society must create awareness about the importance and contribution of women in the industry. With all this in mind. Women in Mining Peru.

With all this in mind, Women in Mining Peru (WiM Peru) was created in September 2016 as a civil society organization, following the invitation of International Women in Mining (IWiM) headquartered in London. This organization counts more than 10,000 women in the mining sector worldwide as members. The objective of WiM PERU is to highlight the role of women in Peruvian mining, promote best corporate practices, contribute to women's comprehensive training, facilitate the exchange of experiences and inspire other women to join the sector.

WiM Peru's official launch took place in March 2017 and since then, its Board of Directors, consisting of experienced women working in the mining sector and related in-



Beyond the search for social justice, a number of international studies are proving that gender diversity directly contributes to the companies' profitability.



dustries, has carried out an extensive effort to promote and position the organization. Today, we have more than 300 active members nationally.

One of WiM Peru's initiatives has been the creation of decentralized branches. Our South Branch covers Arequipa, Moquegua and Tacna. Moreover, we have Student Chapters in Central Peru and in Puno. Another key initiative is our Mentoring program, where members support each other in their personal and professional growth. There is also a monthly event for members called Women & Mines, where we tackle both hard and soft skills and which concludes with a networking space for participants. Women are not used to networking and the development of contact networks is essential during a professional career. Finally, the organization has been active on Facebook, LinkedIn, Instagram and Twitter, and it has also produced a monthly bulletin to reach more women with our message and provide up-to-date information on activities and achievements by women in the industry.

To conclude, WiM Peru firmly believes in gender equality. This means equal opportunities and fair decisions based on the skills of the different professionals. There is a lot of female talent out there, and this talent can perfectly match the needs and expectations of the mining industry.



Industry Explorations

Diana Rake

How is the change in the mining cycle affecting recruitment in the industry?

In 2017, we could see a 35% increase in searches, divided equally between operations and projects. In 2018, we saw a strong start the first trimester with a lot of enthusiasm coming from the PDAC Convention, but the following months slowed down probably as a consequence of the unstable political situation in Peru. By July 2018, however, requests started to speed up and we are expecting more move-

ment.

How is Transearch adapting its service offering to the current market?

Transearch has worked in mining since it started in Peru 17 years ago. At the company, I joined Jorge Velaochaga nearly two years ago. We have a good team of professionals who understand the natural resources language and the nuances of the different company cultures to make the right fit. We accommodate the needs and timings of the client and like to be very honest regarding what we will be able to find

Will the construction of Quellaveco and Mina Justa create stress and salary inflation in the human resources segment?

Competition always helps raise salary expectations but there are not so many projects in South America or the world and there are people willing and able to come to Peru, in the case that Peruvians prefer to stay in operating companies. Most of the technical jobs for these two projects at this stage are temporary. It is hard to attract people working in producing companies, who already have a good annual salary and enjoy profit sharing programs.

What needs to change to have more women at top mining managerial positions?

Organizations like WiM and WAAIME help to shape a more modern mining industry, which includes more women in it. I believe educating men and women to not stereotype gender, and to focus on similarities rather than differences, may be the secret to get more women in managerial positions. Sometimes the way you were raised or expected to behave if you are a woman is not applicable at the men's world, especially in undeveloped countries. It is important to teach children that the sky is the limit for a man or woman.

Alberto Calle

Principal **KORN FERRY**



Could you provide an introduction to Korn Ferry and the services it provides?

Our purpose is to enable people and organizations to exceed their potential. In that line of action, we help companies design their organization - the structure, roles and responsibilities - to seize opportunities. We also help organizations select and hire the talent they need to execute their strategy, and show them the best way to compensate, develop and motivate their people.

How does Korn Ferry's range of services cater for the Peruvian mining industry?

Korn Ferry has a dedicated Global Mining, Metals & Minerals Practice. We have a track record of success at recruiting mine managers, VPs of operations and technical services, COOs and related specialist roles. We also provide customized advisory services on team and leadership development, organizational design, succession planning, management change, diversity and inclusion, strategic compensation and engagement plans, among others. We have around 30 mining companies in Peru that participate in our compensation and benefits survey which provide them key information for their compensation strategies.

What have been the most noticeable trends in mining recruitment recently?

The current rising cycle of metal prices is accelerating the development of new mining projects and expansions. It is also known that in the mining industry, a gap for talent exists which generates high competition for acquiring and retaining critical skills. This is also making potential candidates more selective and interested on non-monetary benefits, internal culture, international exposure and sustainability practices. From the point of view of mining companies, they are looking for leaders with an efficiency mindset and an overall business perspective.

How aware do mining professionals need to be of technological advances in the industry?

As new large mining discoveries become more scarce, have more complex metallurgical conditions, or are in more remote locations, the operational costs and risks tend to increase; so the search to optimize processes is a permanent topic on the CEOs' agenda. It is in this context that the approach towards technological solutions for remote control of mobile equipment, interconnectivity of processes, and detection of fatigue symptoms, among others, must be on the radar and knowledge of mining professionals.

BE PART OF PERU'S MOST STRATEGIC ACTIVITIES AT PDAC 2019, THE BIGGEST MINING CONVENTION IN THE WORLD



March 3 - 6

BENEFITS OF BEING PART OF THE PERUVIAN DELEGATION

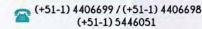
Discuss your company's activities with mining analysts, fund managers and bankers Make important links with a worldwide audience Meet face-to-face with high net worth global mining executives Reinforce relationships with national and international clients Seek out new business opportunities Participate in the most important country activities of PDAC Strategic approach with government personalities





- MORE INFORMATION -CANADA-PERU CHAMBER OF COMMERCE

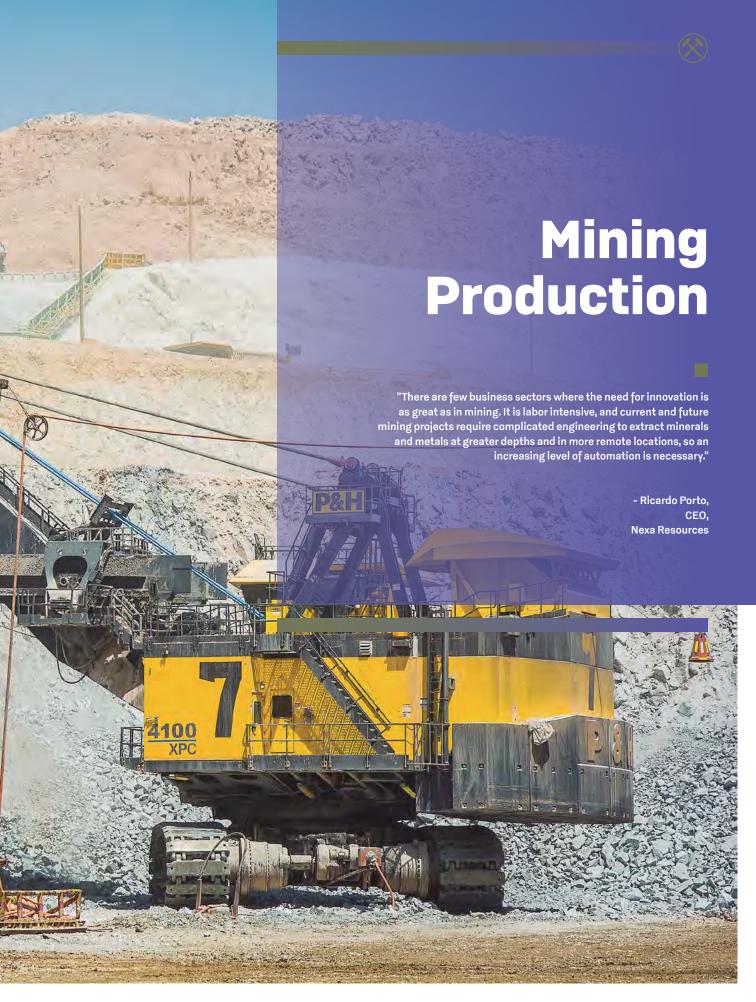
OFFICIAL ORGANIZER OF THE PERUVIAN PRESENCE AT PDAC













Peru strengthened its output in 2017, reaching 2.45 million tonnes

Since 2012, Peru has increased its copper production every year and 2017 was no different. After the spectacular increase of 2016, driven by the expansion of Cerro Verde and the addition of MMG's Las Bambas, output increased by a moderate 3.9% last year, with a total output of 2.45 million tonnes (mt) of fine copper. Cerro Verde is still the largest producer of copper with 501,800 mt/y, followed closely by Las Bambas, which achieved its first year of full production with 454,000 mt/y, a 37.5% increase from its 2016 figures. Peru's third giant copper unit is Antamina, which yielded 439,200 mt/y.

Suresh Vadnagra, president of Minera Las Bambas, commented on the mine's performance on its first year of full commercial production: "Our C1 cost of US\$0.99 positions us as one of the lowest cost producers. In 2017, we took some fairly aggressive steps to establish efficiency as the baseline of Las Bambas, which is something that does not normally happen in the first year of production." Vadnagra anticipated that the copper operation, located in Apurimac, will yield between 410,000 and 420,000 mt of copper in 2018, at a C1 cost between US\$1/ lb and US\$1.10/lb. "Our focus is very much on building on the success of 2017 into the future years," he continued. "Las Bambas has enormous potential for brownfield growth - this includes the development of further satellite pits and resource expansion. The Las Bambas tenement has 35,500 hectares, and so far we have explored less than 10% of it."



PERU MINING 2018 Industry Explorations

Del Rio.

Other copper mines that produce more than 100,000 mt/y include Glencore's Antapaccay (206,500 mt/y), Chinalco's Toromocho (194,700 mt/y), Southern Copper's two units (Cuajone at 161,100 mt/y and Toquepala at 145,000 mt/y) and Hudbay Minerals' Constancia (121,800 mt/y).

Javier Del Rio, VP South America at Hudbay, explained how the company is introducing digitalization to integrate the mine with the process plant: "We have cameras at the apron feeder, and a particle size analyzer that provides real-time information on the material going through the flotation circuit. Additionally, we have flotation cameras that measure the bubbles' formation, size, color and speed. All this needs to be integrated so that we can respond to the ore coming from mother nature on real time. Once we have the material at the flotation cell, it is too late to react."

Hudbay expects the surrounding areas in Constancia to substantially extend minelife. The company plans to put the Pampacancha satellite deposit into production next year, and has also acquired other properties nearby (Caballito, Kuriorcco and Maria Reyna). "The big picture is to have Constancia running for not just another 14 years, but for 30 years. This is why we are focusing on brownfield exploration," said Del Rio.

While the aforementioned mines account for the bigger chunk of Peru's copper production, there are also some interesting medium-sized underground operations. With the ongoing expansion at the Marcapunta

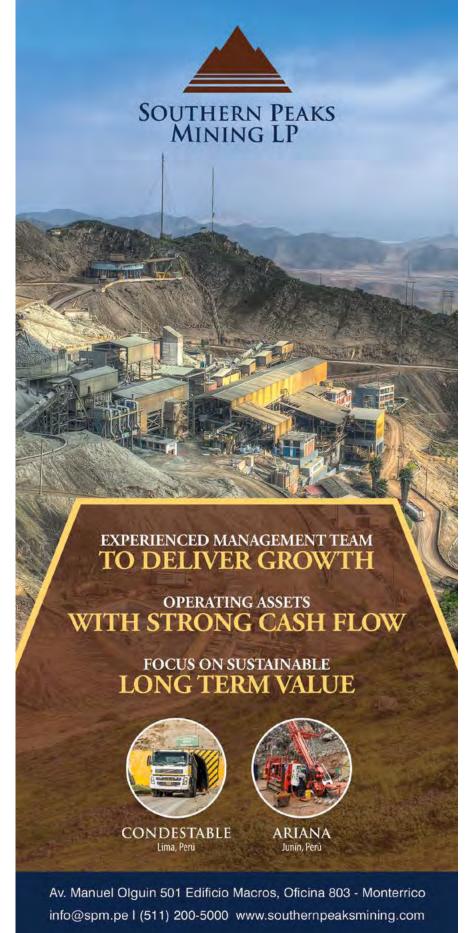


Image courtesy of Nexa Resources



mine, for instance, Buenaventura's El Brocal operation narrowly beat Nexa Resources' Cerro Lindo as the country's largest underground copper producer (both are in the 45,000 mt/y range). Meanwhile, Condestable, operated by Southern Peaks Mining, yielded 22,000 mt of copper in 2017. Víctor Gobitz, CEO of Buenaventura, was enthusiastic about El Brocal's future potential, as Buenaventura has eliminated the commercial restriction that El Brocal's arsenical copper used to have: "There is an opportunity to go from room and pillar to a different mining method that also extracts

the ore from those pillars. If we are successful doing that, the Marcapunta mine could grow up to 20,000 mt/d," he affirmed. Marcapunta is already expanding from 8,000 mt/d to 13,000 mt/d by the end of this year. Southern Peaks Mining has also introduced new mining methods as a way to improve both productivity and efficiency, with a focus on mechanization at Condestable, and is increasing its daily throughput from 7,000 mt/d to between 9,500 mt/d and 10,000 mt/d. Adolfo Vera, Southern Peaks Mining's CEO, said: "We started treating the previously known mantos as ore bod-

ies and, for that, we needed to know the geometry in each particular ore block prior to mining. We then designed the drilling and blasting scope with the knowledge produced from the geology infill findings. That has given us incredible results as we have introduced long hole mining into 80% of our operation, and dilution has decreased by 75%."

Looking at the general picture, Peru's copper production continued to close the gap with Chile, that saw its red metal output decrease slightly to 5.5 million mt/y. The Peruvian government has set a goal of increasing copper production by 30% by 2021 to further cement Peru's position as the second largest producer of copper globally.

The expansion of Toromocho, operated by Chinalco, and the construction of the Quellaveco and Mina Justa greenfield projects are the main highlights in Peru's expanding copper production. Juan Luis Kruger, CEO of Minsur, owner of 60% of Mina Justa, explained the latest steps on what will be the company's first copper mine: "Last year we decided to do some early works and lock in the price and delivery times of the critical equipment. The idea is that, by the time we secure the full financing for the project, we are ready to go and we can shorten the time to market. Meanwhile, we have completed 70% of the detailed engineering to reduce the execution risk."

Mina Justa should be in production around 2020, with an average output in the range of 100,000 mt/y over the mine's life.





Suresh Vadnagra

Executive General Manager
Operations Americas
MMG
President
MINERA LAS BAMBAS



Las Bambas has been able to obtain water efficiency levels that are at the leading practice end of the mining industry. On any given day we will recycle 93% to 97% of our water.



Could you summarize the main facts and figures for Las Bambas in 2017?

2017 was a defining year for Las Bambas. We produced close to 454,000 tonnes (mt) of copper in concentrate at a C1 cost of US\$0.99 per pound (lb), which positions us as one of the biggest and lowest cost copper mines. Las Bambas was the second largest producer of copper in Peru in 2017 and is truly in the top tier in terms of size and cost. In 2017 we took some fairly aggressive steps to establish efficiency as the baseline for Las Bambas.

One of the first steps after commissioning and ramping up the operation was to imagine the future of Las Bambas –how it would operate in five or ten years' time. With this in mind, we developed our digital road map, which leverages new technologies to support us in meeting technical challenges and in driving improvements in safety, productivity and efficiency. This includes progressive implementation of automation, mobilization, real time monitoring and integrated planning platforms, and the use of data analytics and artificial intelligence for real time optimization.

How does a project of that magnitude address environmental challenges?

MMG as a whole sees minimizing its impact on the environment and its use of natural resources as a corporate value. It is also important for us to leave a positive legacy for future generations. Las Bambas has been able to obtain water efficiency levels that are at the leading practice end of the mining industry. On any given day we will recycle 93% to 97% of our water. Another aspect we are focused on is tailings management. We are working with a number of research institutes to understand how to apply tailings technologies in a large scale environment such as Las Bambas to further increase the efficiency of our current model.

How is the relationship with the local communities around Las Bambas mine site?

Las Bambas has invested more than US\$340 million in sustainable development projects prior to commencing production (between 2004 and 2017), in coordination

with the communities and the government. In addition, the Las Bambas Social Fund (FOSBAM) has financed various development projects to benefit the population of the Cotabambas and Grau provinces, with a total amount of US\$64.5 million allocated by the government. The fund has mainly focused on basic sanitation, education, health, agriculture and livestock. Also, Las Bambas has generated more than US\$160 million in royalties and made a contractual commitment to pay 3% of its sales as royalties, in addition to the 32% income tax.

One group alone, however, cannot deliver such sustainable social development; it must be a collaborative effort between the company, communities, local and central governments, NGOs and any other relevant actor. All parties need to recognize what their role is and work together towards the same vision and objectives.

We have already seen the immensely positive impact that the presence of Las Bambas has had on the region of Apurimac, which used to be the least developed region in Peru and is now the fastest growing. In MMG, we proudly say that we mine for progress, creating real wealth for the people that work for us, for our host communities and for our stakeholders; including the government and country of Peru.

What is MMG's strategy for growth and expansion?

Our focus is very much on building on the success of 2017 into the future years, with efficiency and productivity already contributing to improving results. In 2018, our production guidance for Las Bambas is between 410,000 and 420,000 metric tons (mt) of copper, at a C1 cost of between US\$1/lb and US\$1.10/lb. Las Bambas has enormous potential for brownfield growth, through resource expansion and the development of further satellite pits. The Las Bambas tenement has 35,500 hectares, and so far we have explored less than 10% of it. MMG has a vision to be one of the world's most respected mid-tier mining companies. Our strategy is focused predominantly on growing in zinc and copper, our two core commodities, and growing in the regions that we are currently operating in -Australia, Africa and South America.



Javier Del Río

VP South America Business Unit **HUDBAY MINERALS**



Constancia was not the finish line, but our starting point. We now have a team in place to evaluate other projects, so we remain open to make new investments and acquisitions from greenfield exploration to advanced projects.



What has been Constancia's performance over the last year?

Constancia is located in a very remote location, at 4,200 meters above sea level. Our results in the first quarter were better than in the same period of 2017 -indeed we have recently achieved some nice records in mill throughput. We have been running some operational improvements like automated process controls. We believe that technology is key to achieve good results, and we are using technology not only for the process plant, but also to integrate the mine with the mill. In 2017, we had production of 121,781 metric tons (mt) of copper. Our 2018 guidance reflects copper production between 95,000 and 115,000 mt of fine copper, and between 65,000 and 85,000 gold equivalent ounces.

Could you develop on the latest technology introductions?

One of the big hurdles we have been facing is the rock fragmentation issue. On one side, you have the fleet management systems that allocate equipment to the right places and manage all the trucks. On the other, you have the information coming from the penetration rates of the drilling rigs, and you need to link all of that to the hardness of the rock. To integrate all that information, we have cameras at the apron feeder, and a particle size analyzer that provides real-time information on the particle size in microns of the material going through the flotation circuit. Additionally, we have flotation cameras that measure the bubbles' formation, size, color and speed, providing the right information about dosage of reagents. All this needs to be integrated in the future into an optimizer system, so we can respond to the ore coming from mother nature in real time. In other words, once we have the material at the flotation cell, it is too late to react and there is limited room for optimization.

What is the potential of Pampacancha to extend mine-life?

We foresee that Pampacancha will come into operation in 2019. Negotiations are well under way with the community, and we have started some hydrogeological early works. It is a 45-million mt ore body that will have an expected mine life of five

years. It will be important for its precious metals content. Having said that, the big picture is to have Constancia running for not just another 14 years, but for 30 years if possible. This is why we are focusing on brownfield exploration around Constancia. The nearby properties we have recently acquired (Caballito, Kusiorcco, and Maria Reyna) are very prospective, and probably at some stage they will replace the material coming from Constancia. In any case, beyond the Constancia area we also have 80,000 hectares in different parts of Peru where we are conducting greenfield exploration. Our exploration budget in the country is around US\$10 million this year.

Could you tell us about Hudbay's initiatives to promote development?

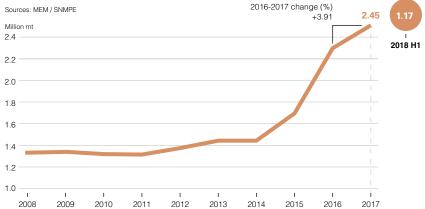
We believe that our neighbors are also part of our team and that we should create sustainable development so that the local populations do not rely solely on the mine for a living. We have created an alpaca corridor in the Chumbivilcas province, grouping alpaca farmers to improve grass conditions, wool production and wool quality. We are also helping them with a plan to reach destination markets and obtain better prices for their product. Besides, we have been supporting irrigation programs and implemented initiatives for the certification of dairy products. We are also bringing international cooperation to increase development funding in Chumbivilcas.

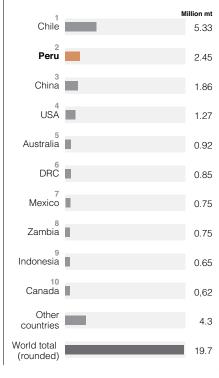
How do you see copper fundamentals?

There is an increase of copper demand driven by the rise of electric cars, and also there are not many projects available, so there is strong appetite in the market for advanced projects. This does not come to me as a surprise. There are very few construction-ready projects, and worldwide you can see an overall declining grade in the operating mines. The outlook for copper remains very positive in terms of price.

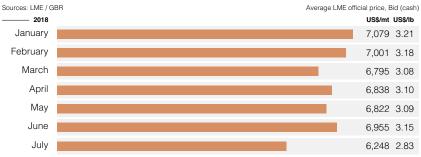
What is the future of Hudbay in Peru?

Constancia was not the finish line, but our starting point. We now have a team in place to evaluate other projects, so we remain open to make new investments and acquisitions from greenfield exploration to advanced projects.











31



Adolfo Vera

President and CEO
SOUTHERN PEAKS MINING

11

Our aim is to be a debt-free copper vehicle that has continuous, organic growth. Ariana will initially process 2,000 mt/d and then we plan to increase that to 3,000 mt/d by 2021. By then, Condestable will be working at 9,500 mt/d, with a combined copper equivalent production of 50,000 mt/y.



Can you give us an update on Southern Peaks Mining?

2017 was a great year for Condestable from a production and financial standpoint. Copper production was at 22,000 metric tons (mt), gold was at 13,500 ounces and silver was at 320,000 oz, which were all company production records. The exploration at Condestable is rendering great results as well, and we expect to be mining there for longer than 20 to 25 years. With the current metal climate, we are expanding our capacity of production from 7,000 mt/d to between 9,500 mt/d and 10,000 mt/d. From a cost standpoint, we have stabilized the C1 cost of copper at Condestable to US\$1.55/lb and, with the expansion of the mine, it can be reduced to US\$1.25/lb. It will be a very low cost mine, with essentially the same grades we are currently mining. The all-in sustaining cost (AISC) is currently US\$1.70/lb with only an expected increase of US\$0.10/lb to US\$0.15/lb moving forward.

What have been Southern Peaks' efforts to mechanize Condestable?

The mechanization of Condestable is producing very good results, not only in mining efficiency but also increasing our knowledge of the ore body. We started treating the previously known mantos as ore bodies and for that we needed to know the geometry in each particular ore block prior to mining. We then designed the drilling and blasting scope with the knowledge produced from the geology infill findings. That has given us incredible results as we have introduced long hole mining into 80% of our operation, and dilution has decreased by 75%. This has allowed us to work much more efficiently with a lot less people. The success of our advancement mining method has now been replicated in a number of mines. We are mining at 4.5 x 4.5 meters now and we would not go narrower than that, because our extraction is made using trucks and we also have to fit ventilation sleeves in the tunnel.

Can you tell us about the current progress and potential of the Ariana project?

Ariana is due to receive its last permit in 2018. From there, we will be ready to build. The project will take six quarters, so by early 2020, we should be producing our first concentrates. The main reason for us to do an IPO is actually to raise capital to build Ariana. Our aim is to be a copper vehicle that has continuous, organic growth, is fully financed and remains debt-free. Ariana will initially process 2,000 mt/d and then we plan to increase that capacity to 3,000 mt/d by 2021. By then, Condestable will be working at 9,500 mt/d, with a combined copper equivalent production of 50,000 mt/y, taking into account the silver, zinc and gold credits. We will have a size comparable to the mid sized copper players on the TSX. Beyond that, we are also looking at making two acquisitions, and will probably bid for the Cobriza mine.

What is Southern Peaks' strategy toward safety?

We had a sensational year with only five lost-time accidents, which is significantly lower than what Condestable had before. Our last fatality was in 2009. In 2017, we beat the 1 million man hours without accident three times. The key behind our record is our engagement in programs for safety behavior, which forces our workers to take responsibility for their actions. There has traditionally been an attitude that not wearing protective gear or entering into unsafe activities is a sign of bravery, but it is rather a sign of stupidity and we are changing that. Furthermore, all the operations in Condestable are performed by our own labor and any contractor that works on development at our mines is our own responsibility and so is thoroughly trained. Safety cannot be compromised in any situation.

What is your expectation for copper in the coming year?

The status of the market in terms of supply and demand is not that transparent. Although, as there has been a lack of exploration and not many large projects worldwide, I believe copper will be in shortage for the next two to three years. We are very bullish on copper.

33

Gold

Peru's main gold mines are maturing, and production will increasingly come from medium-sized operations

Peru maintains a key position in precious metals mining and development. In 2017, it remained the world's sixth largest gold producer (and the largest in Latin America), while it was also the world's second largest silver producer, only after Mexico.

Peru's gold production remained relatively stable and only recorded a 1.2% decrease year-on-year. Total output reached 4.86 million troy ounces, with Yanacocha contributing 535,700 oz. This still places the operation, located in Cajamarca, as the country's largest gold mine despite its continuous decline. The guidance for this year is around

the half a million-ounce mark and, with the Quecher Main project, its life should be extended until 2027. Quecher Main, a US\$250 million to US\$300 million venture, will add new output from oxides starting next year, with expected production of 200,000 oz/y between 2020 and 2025.

Yanacocha is a joint venture between Newmont, that operates the mine, Buenaventura, and Sumitomo, that recently acquired a 5% stake. On top of its share of production at Yanacocha (43.65% of the total, or 233,400 oz), Buenaventura also had an additional attributable production of 383,200

ounces from the other gold mines it operates, namely Tambomayo, Orcopampa, La Zanja and Tantahuatay.

Víctor Gobitz, CEO of Buenaventura, anticipated higher production figures this year from Tambomayo, which reached commercial production last year, and at Coimolache, where the company is processing the oxide stockpiles acquired from neighboring Cerro Corona. He also provided more details about the three-year debottlenecking project at the company's main underground mines: "In Orcopampa, the deeper side of the mine offers high grade but we have not



Industry Explorations PERU MINING 2018

developed a shaft, so with the ramp we are extracting less volumes at higher costs, including additional ventilation costs. In other mines, we are implementing better ventilation or dewatering solutions to extend the mine cycles. We also want to move our backfill around as slurry, with pumps, rather than having to use trucks and scoops."

Gobitz explained that allocating funds to improve efficiency presents less technical risk and a quicker return on investment than developing a greenfield project. Having said that, Buenaventura also has some precious metals projects in the pipeline, including the San Gabriel gold project and the Yumpaq satellite silver deposit at Uchucchacua.

Beyond Newmont and Buenaventura, the other large gold producers include Barrick, that recorded 508,700 ounces between Lagunas Norte and Pierina; Tahoe Resources, that produced 275,000 oz at its La Arena

and Shahuindo mines; and Gold Fields, that had production of 166,000 oz of gold at Cerro Corona, a medium-sized mine in Cajamarca that also provides important copper volumes (gold equivalent production is 314,000 oz).

Stretching mine-life

In 2017, Barrick's Lagunas Norte produced 387,000 oz at an all-in sustaining cost (AISC) below US\$500/oz, while there is an expected decline to between 230,000 and 270,000 oz this year, related to the depletion of the oxide ores. One of the main developments in 2018 is the building of a dry screener, while the company continues working on the refractory ore project (PMR in Spanish). Lagunas Norte has around 4 million ounces in reserves, most of which is sulfides.

We closed 2017 with 254,000 oz of gold produced, beyond our guidance of 232,000 oz, thanks to expanded operations and higher grades. For 2018, the plan is to produce 270,000 oz. This γear we should complete the first phase of the Santa María plant expansion to go from 600 mt/d to 800 mt/d.

Together with the 800 mt/d from

the Marañón plant, we will have a

processing capacity of 1,600 mt/d

later this year in the Pataz area.

- Marcelo Santillana,
general manager,



Poderosa

According to the company's executive director in Peru, Manuel Fumagalli, a transitional phase for mine-life extension would involve a mill and carbon-in-leach recovery circuit to process the medium-to-high carbonaceous oxide material in the stockpiles for a total output of 600,000 oz between 2021 and 2026. Then, the PMR project would require a flotation and autoclave process for the sulfides and, if approved, would produce 2.2 million ounces starting in 2026. Meanwhile, Gold Fields has also pushed to add mine-life at its Cerro Corona mine, with a seven-year extension to this operation, now expected to be running until 2030. Luis Rivera, executive vice-president of Gold Fields for the Americas, explained: "Mining is like a credit card, it has an ex-





Manuel Fumagalli

Executive Director **BARRICK**

We are reinforcing our digitalization initiatives, with the goal of establishing a unified global platform to handle all the information. We have already had good results with the short-term interval control initiative.

In Lagunas Norte this led to significant improvements in our activated carbon in column circuit.

Barrick's founder Peter Munk passed away this year. What is his legacy at the company?

As an entrepreneur, Peter Munk imprinted a special DNA into Barrick as a very agile and flexible company, with strong financial discipline but with the ability to take risks and grow. This way, he transformed Barrick into the largest gold producer worldwide, reaching some 25 mining operations. He achieved that with impeccable ethics, a culture based on people, and an operational excellence that led us to improve constantly. In 2014, Barrick relaunched this original idea with the 'Back to the future' initiative, looking for a leaner, decentralized and more agile structure.

What are Barrick's main areas of focus for 2018?

We continue our efforts to reduce our debt even further and maintain our financial discipline, with defined bottom lines for the return on investment. We are reinforcing our digitalization initiatives, with the goal of establishing a unified global platform to handle all the information. We have already had good results with the shortterm interval control initiative. In Lagunas Norte this led to significant improvements in our activated carbon in column circuit. We focus on growing positive free cash even at a price of US\$1,000/oz gold. Being the largest gold producer just for the sake of it is not our focus. Our focus is to have quality production driving industryleading margins. The industry has learnt that increasing production just for the sake of production can lead to bad business consequences, considering prices are volatile and value is not maximized.

Particularly in Peru, what where the main operational highlights in 2017?

2017 was a positive year; we had some challenges but we were able to meet our guidance for production and costs, with 387,000 oz produced at Lagunas Norte and an all-in sustaining cost (AISC) below US\$500/oz. On top of that, we had a 43% improvement in our safety ratio (TRIFR), as well as increased efficiency related to our Best-in-Class and digitalization initiatives. This year, our guidance is between 230,000 and 270,000 oz. The decline is in line with expectations as the mine matures and progressive depletion of oxide ores.

One of the main developments this year is building a dry screener, because we have low carbonaceous material stockpiles from which we can separate the clean coarse ore from the carbon using this process, and send it to the leach pad for beneficiation.

What are Lagunas Norte's remaining reserves, and what are the transition steps to start processing sulfides?

We continue to look for new material to extend our oxides operation as much as possible. Last year, we added some 390,000 oz to our reserves, that are standing at 4 million oz as of December 31st, 2017. Most of that is sulfides and therefore will come online with the upcoming life extension refractory project. The first step considers the processing of the medium-to-high carbonaceous oxide material stockpiled that will require a mill and a carbon-in-leach recovery circuit (known as the CMOP project). Subject to completing the detailed engineering this year and obtaining the pending approvals to execute, this should yield some 600,000 Au ounces in total from 2021 to 2026. The second phase, known as PMR project, will focus on the refractory (sulfides) ore that requires adding a flotation and pressure oxidation (autoclave) process. With the current numbers, this second part could produce some additional 2.2 million ounces starting 2026, if all required governmental and internal approvals are obtained.

Pierina yielded more than 120,000 oz last year. What is the current status of the mine closure?

Pierina is still undergoing its progressive closure program, with some incidental production. We want Pierina's closure to be a successful model, so we are implementing several communication initiatives to explain that closure is not abandoning an environmental liability, it is a thorough program with important resources assigned to it. We have implemented an additional control mechanism via an automatic water discharge monitoring system, which is able to detect any cyanide content as well as seismic events, automatically closing the channel discharge gates if such an event should happen. Furthermore, this year we will implement an automatic water management system to control the water levels and balance of the whole operation.

Luis Rivera & Alberto Cárdenas

LR: Executive VP Americas
AC: VP Operations*
GOLD FIELDS

*Until July 2018.





How is mine-life being extended at Cerro Corona?

LR: Cerro Corona had a wonderful performance in 2017. It delivered 314,000 gold equivalent ounces, which is a record for the operation. We reported zero lost-time incidents and just one medical treatment, which is also a world-class safety record. Our operating cost was less than US\$700 per gold equivalent ounce. Cerro Corona is a very efficient operation; we call it a 'boutique' mine – for Peru, 40,000 mt/d may not sound big, but in terms of sales this is a very important asset with revenues of US\$400 million last year. Cerro Corona is also the best operation for Gold Fields worldwide in terms of margins.

Mining is like a credit card, it has an expiration date. At the beginning of 2017, Cerro Corona was scheduled to shut down in 2023. That meant that, from 2018, we would have had to start closure activities, reducing our footprint and our workforce. We made it an urgency to extend the mine life. Cerro Corona is now scheduled to be running for seven more years until 2030. Our vision is to be the leaders in sustainable gold mining, and keeping our organization alive in Peru is an essential part of that.

How challenging was it to extend the mine-life, considering your land limitations?

AC: We had to think strategically. The beauty of the solution is that we are extending the life of the mine but not the superficial footprint. Everything is happening within the property limits. We are challenging the density of the tailings to accommodate more volume within the same facility. Also, at the end of the day the pit is also an asset, so we are looking at placing some tailings within the pit after the operation.

Below the reserves pit we have continuity in the mineralization, so the challenge lies on the technical front: how we can get that copper and gold out of the ground in an economic manner. This is why we are focusing on innovation, because this all has to do with stripping ratio, transportation costs and processing costs. Last year we outperformed our cost guidance by 32%.

The more we improve that, the more opportunities we will have to extend the mine life. If we solve the technical issues, I can easily see Cerro Corona producing until 2040.

How are you adapting your corporate structure to incorporate more innovative ideas?

LR: We are very aware of the latest trends in the industry. With the fourth industrial revolution, we are giving the young engineers the space to change the way we run our business. In the past, there was a topdown approach. We are increasingly using technology, for instance, with proximity detection systems for the mining trucks, remote control systems for the pumping stations, and GPS systems for the trucks along the corridor to the port. Also, the industry has learnt from its past mistakes. In 2011 and 2012, it was a party for everyone, and expenses were very high. Today, we keep a lean, talented team and we outsource to other companies when we need help.

Beyond Salares Norte in Chile, which other growth opportunities do you see in the Americas?

LR: Salares Norte is a fantastic project: if you compare its 25-km radius to what you have in other world-class mines like Yanacocha, Veladero or Pierina, the environment is very similar. The Americas still host big gold deposits, but they are hidden under glacier tilt so they are not exposed to plain sight. Besides Salares, we are looking for other projects. We have a team working in central and southern Peru. We typically look at advanced projects that already have a discovery, and we do not rule out making acquisitions either.

What do you expect from the regional elections in Peru this year?

LR: We are used to working in Cajamarca. It is not the easiest environment, but since we started there has not been much opposition. Our social programs are very proactive and we have a good reputation in the area. We hope that, with the election, the political side of things will be more favorable to mining moving forward.



Víctor Gobitz

CEO
BUENAVENTURA

Todaγ, base metals represent 50% of our business. We will continue to produce gold and silver, however copper will also be an important component for us to bring value to shareholders. In this respect, the integration of El Brocal is an important step for us.

77

What were the main milestones for Buenaventura in 2017?

The main milestone in 2017 was the achievement of commercial production in Tambomayo in August. Besides, on our four main underground mines (Tambomayo, Orcopampa, Uchucchacua and Marcapunta) we are developing a three-year debottlenecking project to reduce costs and enhance our exploration programs. On the exploration side, we had very good results in a new area of Uchucchacua called Cachipampa, while we continue to grow the potential of our Yumpaq area, a satellite deposit.

In base metals, a great milestone was the integration of El Brocal within the Buenaventura structure. On the operational side, we could connect the northern and southern areas of the Marcapunta mine. In 2017 we also signed an agreement with Gold Fields whereby we have acquired their oxides stockpiles, which will add to Coimolache's production. Finally, Yanacocha approved the development of the Quecher Main project, which will extend its mine-life until 2027.

What are your expectations for this year from an operational perspective?

In 2018 we expect better results thanks to the improved base metals prices and the large, stable volumes from Cerro Verde. In gold we are going to increase production in Tambomayo and Coimolache, while in La Zanja we will see a decline -we will evaluate the development of a copper project there. In silver, where Uchucchacua is the main asset, we are also going to increase our production and improve our costs thanks to the better grades from the Cachipampa area; we are also integrating Mallay with Uchucchacua. Finally, at Julcani, we are focusing on two main areas, the Acchilla mine and the Taipe-Galindo area; we are suspending operations at the Estela mine, which is more remote and presents higher costs; this way we are going to centralize the operation, reducing our footprint.

How much more can El Brocal still grow?

With the integration tunnel in the underground mine and the improvements of the processing plant, the copper mine should

produce 13,000 mt/d by the end of the year, as opposed to 8,000 mt/d at the beginning of 2018. This is an important project because with today's copper prices, the margins from Marcapunta are going to be stronger than the ones from the zinc/lead open pit operation of El Brocal. There is also an opportunity to change our mining method from room and pillar to a different method that also extracts the ore from those pillars. If we are successful doing that, the Marcapunta mine could grow up to 20,000 mt/d.

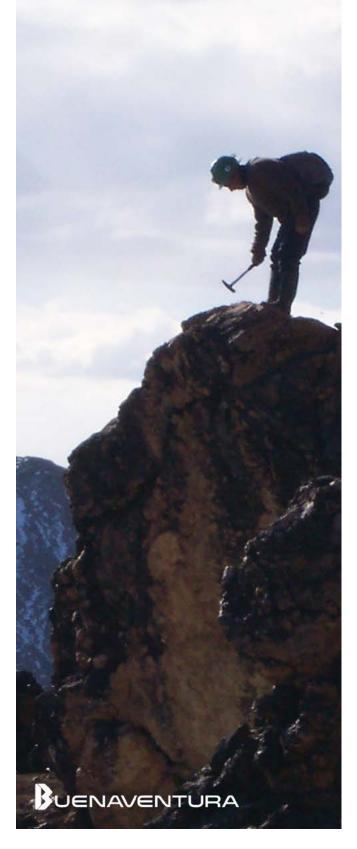
Beyond Cerro Verde, will we see Buenaventura making additional investments in large copper operations?

Today, base metals represent 50% of our business. We have 65 years of experience doing business in Peru, and our vision is to have a long-term, profitable business. We will continue to produce gold and silver, because we have a great portfolio of projects, however copper will also be an important component for us to bring value to shareholders. In this respect, the integration of El Brocal is an important step for us: the open pit there is a medium-sized operation with concentrates that are more complex than what you find in a gold operation, and that is an expertise we need to have in-house, to be ready to develop other operations in industrial minerals.

What are the main developments on the greenfield project front?

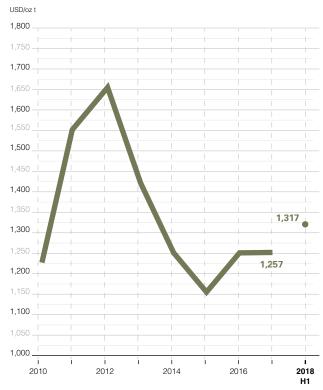
In gold, we have San Gabriel. In silver, we have Yumpaq, and in base metals we have San Gregorio at El Brocal, as well as Faique and Trapiche. At Trapiche, the EIA is still in progress, but from the point of view of the mining method and the metallurgy, the project is very advanced. In 2018 we want to sign a long-term agreement with the community, to reduce the risk. Meanwhile, San Gabriel is an underground project, very similar to Tambomayo. Both the EIA and the agreements with the community are in place, however there we have some technical doubts about the mining method, which currently limits our margins. This year we want to increase our knowledge of the geomechanical aspects to develop a more efficient mining method. If we are successful, by 2021 we could be announcing the construction decision.

Buenaventura, 65 years of responsible mining contributing to Peru's development



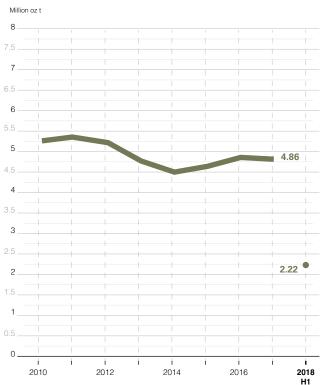
GOLD AVERAGE PRICE

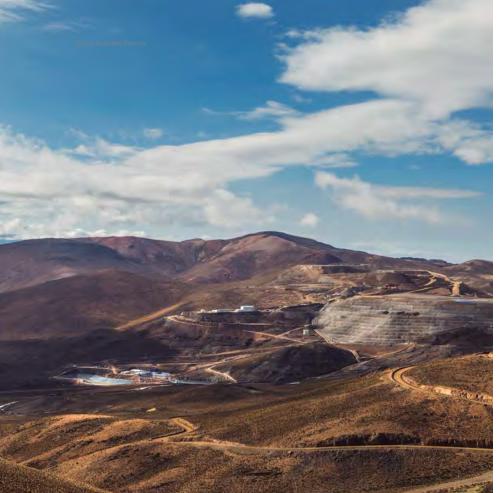
Sources: Kitco / GBR



PERU'S GOLD PRODUCTION

Sources: MEM / SNMPE / GBR







We asked for the support of the different authorities and, as a result, we were able to eradicate 90% of the illegal mining activity in the area of the El Toro project. As part of the process, we integrated many of these miners to our workforce. Today, we employ nearly 1,300 people who have access to all the benefits of formal employment.

- Jaime Polar, general manager, Corporación del Centro (CDC Gold)





< 34

piration date. At the beginning of 2017, Cerro Corona was scheduled to shut down in 2023. That meant that, from 2018, we would have had to start closure activities, reducing our footprint and our workforce. We made it an urgency to extend the mine life."

Considering the space limitations Cerro Corona faces in Cajamarca, achieving this took its share of engineering and creativity. Alberto Cárdenas, who handled the life extension plan as vice-president of operations at Gold Fields, commented: "The beauty of the solution is that we are not extending the superficial footprint. We are challenging the density of the tailings to accommodate more volume within the same facility. Also, at the end of the day, the pit is also an asset, so we are looking at placing some tailings within the pit after the operation."

Also in Cajamarca, Tahoe Resources continues to ramp up its operation at Shahuindo, where it is commissioning a crushing and agglomeration (C&A) plant to improve recoveries from the fines of the ore body (production of 79,000 ounces in 2017 came from run-of-mine ore). Once the plant is commissioned, Tahoe will embark on the

expansion of Shahuindo from 12,000 mt/d to 36,000 mt/d. "Our other Shahuindo projects, such as resourcing water, constructing pads and building a transmission line, are also key. Near-mine and satellite geological deposits in the north corridor of Shahuindo provide us potential targets to extend and maximize value at this operation," said Phil Dalke, until recently vice-president and managing director of Tahoe Peru.

Peruvian companies account for significant gold production as well. These include Poderosa (254,000 oz/y), Horizonte (253,000 oz/y), and Hochschild Mining, traditionally a primary silver producer, that has been increasingly leaning towards gold production with the impulse of the Inmaculada mine. Hochschild produced 203,600 oz of gold in Peru last year, and 165,000 of those ounces came from this flagship asset. With respect to Poderosa, the company is currently expanding its processing capacity from the combined 1,400 mt/d in between its Marañón and Santa María plants, to 1,600 mt/d by the end of this year. One of the main items of the expansion in terms of the capex are the tailings dams, explained Marcelo Santillana, general manager of Poderosa: "With the investments in the Livias and Hualanga facilities, the tailings dams will now have a life of 22 years. Moreover, we filter the tailings, so we do not deal with pulp anymore."

Poderosa expects to produce 270,000 ounces of gold this year and continues to look at formulas to optimize production and extend mine-life.

Elsewhere in La Libertad, Corporación del Centro (CDC Gold) is advancing the El Toro project, an epithermal gold deposit hosting around 1 million ounces, that is being developed as an open pit operation with heap leaching and a carbon-in-column plant. Initial production is estimated at 100,000 oz/y.

Construction is already under way and mining operations should start before the end of the year. Jaime Polar, general manager of CDC Gold, gave more details: "Our stripping ratio is quite good, just 2:1 according to our mine plan, and we also have favorable hydrogeological studies that indicate that we will not have to dewater the pit. In its first phase, the capital investment to put El Toro into production amounts to around US\$150 million.".

Industry Explorations

The latter company had production costs of around US\$12.5/oz silver equivalent last year, and those should increase slightly in 2018 to between US\$13/oz and US\$13.4/oz according to the corporate guidance. Part of this cost increase is the US\$30-million investment in the Pablo development at the Pallancata mine in Peru. "In 2017, Pallancata was working at 1,400 metric tons per day (mt/d). Through incremental expansions, we will reach 2,800 mt/d by Q3 2018, and production will stabilize at that rate," explained Ignacio Bustamante, CEO of Hochschild Mining.

A new player in Peru is Great Panther Silver, a company with operations in Mexico, that is working to reopen the Coricancha mine in Peru after acquiring the asset from Nyrstar. The company has recently published a preliminary economic assessment (PEA) that anticipates future production from Coricancha will be 3.1 million oz/y, an

SILVER AVERAGE PRICE Sources: Kitco / GBR USD/oz t 36 34 32 30 38 26 24 22 20 17.0 18 16 16.6 14 12 2010 2011 2014 2015 2016 2012 2013 2017 2018 H1 PERU'S SILVER PRODUCTION Sources: MEM / SNMPE / GBF Million oz t 160 150 138.4 140 130 120 110 100 65.8

internal rate of return (IRR) of 81% and a relatively low capex to get the mine restarted at US\$8.8 million. The initial mine-life of four years comprises 28% of Coricancha's resource statement. Great Panther is now embarking on a 6,000 mt bulk sample program to test the mining method, recoveries and dilution rates. Great Panther's objective is to have the mine fully up and running by the end of 2019.

2012

2013

2011

50

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2010

"Our study anticipates using a combination of resue mining and captive cut and fill, which is a mechanized method with very small equipment," said James Bannantine, president and CEO of Great Panther Silver. "Nyrstar suffered from dilution, so our main focus is going to be dilution-control, which means lower volume and higher selectivity for narrow mining width, as well as having more mining faces," he concluded.

2016

2017

2015

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We had the idea of buying a mining operation that would allow us to build a mining company in a bottom-up fashion. We came across Recuperada and we thought that it had the right features. First, it is strategically located in Huancavelica, one of Peru's historical mining districts. Secondly, we saw an opportunity to add value to the project by bringing a more ambitious mining vision.



- José María García, CEO, Mining Sense



Meanwhile, Bear Creek Mining continues advancing at Corani, a very large silver deposit with significant base metal content. Potentially moving into construction over the next year, and with expected production of 12 million oz/y during the first six years of operation, Corani is one of those 'company makers' that do not come in production very often in the industry.

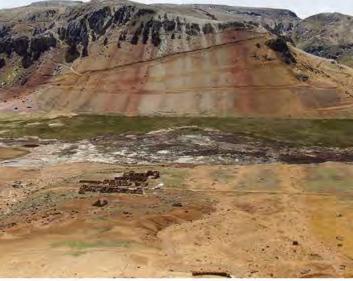
Of course, such a large project brings significant risk with it. Through recent engineering, the company has reduced the estimated capex of the project to a US\$585-million figure, which is still high for a junior player transitioning to become a mining company. Anthony Hawkshaw, president and CEO of Bear Creek, said: "There are areas to save money and initial engineering observations have identified possible capex reductions."

Peru's rich silver and polymetallic ore deposits are also attracting new players to the industry, such as Mining Sense, a company that recently acquired Recuperada, one of Buenaventura's former historic mines. Mining Sense is putting the asset back into production, initially sourcing the ore from third parties.

José María García, CEO of Mining Sense, explained the rationale behind this strategy: "We are surrounded by a number of operations, including many small mines that produce less than 100 mt/d. A number of these companies send their ore to processing plants on the coast at very high costs. With the restart of Recuperada, we will allow these miners to dramatically lower their costs, while we will be able to blend different concentrates, improving our marketing position."

The cash-flow generated by this initial production should allow Mining Sense to restart mining operations at Recuperada a few months after. García affirmed that the company has put together a land package containing in excess of 50 veins and 5 million mt in reserves, while Recuperada's plant has a nominal processing capacity of 600 mt/d.





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Ignacio Bustamante

CEO
HOCHSCHILD MINING

11

We have restarted our greenfield program, with the drilling of the Fresia project in 2017. We are planning on drilling four to six greenfield projects in Peru, Chile and the USA in 2018. We have put aside US\$10 million for exploration programs in these sites.



Can you give us a brief overview of Hochschild's operations in 2017?

2017 was a very positive year for the company with our production figures exceeding our initial guidance. Production was at a company record 38 million ounces (oz) of silver equivalent, 1 million oz higher than expected and we expect the same figure in 2018. In-maculada continues to be our strongest asset, delivering 17 million oz/y, with Pallancata delivering 7.5 million oz/y. The all-in sustaining cost (AISC) for 2017 was US\$12.3/oz. In 2018, the AISC guidance is between US\$13/oz and US\$13.4/oz.

What explains the production cost increase for this year?

Firstly, there are certain pressures on currencies, for example in Argentina, with inflation continuing to be higher than devaluation. Furthermore, the development of the Pablo mine at Pallancata was due to start in 2017 but as permits were delayed, the development cost will be loaded into 2018. Additionally, we have a large capex project to install a hydraulic backfill system in Argentina at a cost of US\$13 million as well. There are also other factors including increased labor costs, contractor prices and other external pressures.

What are the main pillars of Hochschild's strategy for the coming months?

First, we are focusing on our brownfield sites, and we have already started drilling aggressively to increase our current resources. We currently have spare capacity in Arcata, Pallancata and at the Ares plant, so the impact of this brownfield investment is potentially very high. Furthermore, we have also restarted our greenfield program, with the drilling of the Fresia project in 2017. We are planning on drilling four to six greenfield projects in Peru, Chile and the USA in 2018. We have put aside US\$10 million for exploration programs in these sites. Our approach in this respect has changed, as we used to operate these projects through regional offices, but this was expensive and so we are now leveraging joint ventures with local companies that have good expertise.

What is the current financial position of the company, and what impact will Pablo have on this?

Before Inmaculada started producing, our net debt to EBITDA ratio was in the 5-6 range. However, this year it is down to 0.35, representing very little debt and a very strong balance sheet. We had issued bonds for the construction of Inmaculada when the market was not favorable, at an interest rate of 7.75%, but now we have been able to repay those bonds and have replaced them with a US\$200 million loan at 2% interest.

Pablo's development will be a US\$30 million investment. In 2017, total production in Pallancata was 1,400 metric tons per day (mt/d). Through incremental expansions, we will reach 2,800 mt/d by Q3 2018, and production will stabilize at that rate. 2017 was a great year for Pallancata as it was very profitable, with the development of the higher-grade Pablo Pisos areas. Although the grade will now fall with the development of the main body, the tonnage will increase and so will production, from 7.5 million oz/y to approximately 9.5 million oz/y.

How do you think silver and gold will behave in 2018?

We are very positive about the potential upside of precious metals in the long term. There will be significant pressure on the supply side, resulting from the reduced exploration efforts and the relative lack of exploration success all over the world. What is more difficult to estimate is the demand side, as this is strongly dependent on the U.S. economy and its interest rates. There is also the impact of crypto-currencies, which are currently taking funds away from gold and silver.

What will be the highlights for Hochschild in 2018?

We hope to continue delivering at our brownfield sites as we have all the permits in place. We are also going to expand our drilling programs and will look to incorporate more greenfield projects into our portfolio. In regards to Inmaculada, we have recently found nine new structures, and we will continue to drill these areas, at a narrower mesh to define the resources. If we are able to justify 50 million oz of resources, we may be able to increase Inmaculada's plant capacity to 4,200 mt/d.



James Bannantine

President and CEO

GREAT PANTHER SILVER



All of our capex and drilling goes
to our all-in sustaining cost, so
we do not want to overspend in
drilling. Our Mexico's mine has
had a four-year mine-life for over
10 years. At Coricancha, once we
get into the mine, we will have an
opportunity to transfer more of
the remaining resources to the
mine plan for phase II.



What attracted you to Great Panther Silver to join as CEO?

I joined Great Panther in August of 2017, after spending six years as the CEO of Aura Minerals, so my focus is mining in Latin America. I liked the combination of the steady and profitable production Great Panther has in Mexico with the growth opportunities elsewhere in the region, the first of which is Coricancha in Peru. We are currently producing a bit more than 4 million silver equivalent ounces, between our Guanajuato and Topia mines. Coricancha will add 3 million extra ounces so it will provide a 75% increase in the production level for Great Panther.

What is the status of the Coricancha mine?

We published the latest preliminary economic assessment (PEA) for Coricancha in May 2018, and it contained no surprises. Coricancha used to produce 3 million ounces of silver equivalent annually, and the PEA shows an expected production of 3.1 million ounces, with an average head grade of 768 grams/tonne (g/mt) silver equivalent, split between gold, silver, lead, zinc and copper. It offers a very good internal rate of return (IRR) of 81%, and a net present value (NPV) of US\$16.6 million, as well as a relatively low initial capex to get the mine restarted, of just US\$8.8 million.

We have a four-year mine-life to begin with, in a mine plan that uses 28% of our resource statement. The immediate next step for us is a 6,000 mt bulk sample program to test our mining method, recoveries, and dilution rates. Assuming that is successful, we will restart the mine next year to have it fully up and running by the end of 2019.

Nyrstar shut down Coricancha in 2013. What is your approach to have a profitable operation?

Nyrstar's strategy was a high volume approach to feed their smelters, while we are going after high grade and high margin. We are a narrow-vein mining company: if you look at Guanajuato, the mine has a 90-centimeter (cm) vein, and Topia has a system with a 25-cm vein. Coricancha sits somewhere in the middle, with a vein of around 55 cm and a plant that will process 600 mt/d. We expect to develop most of Coricancha with modified mechanization. Our study anticipates using a combination of resue mining and captive cut and fill, which is a mechanized method with very small equipment. Nyrstar suffered from dilution, so our main focus is going to be dilution-control, which means lower volume and higher selectivity for narrow mining width, as well as having more mining faces.

Coricancha has a history of more than 100 years of operations, on and off. How long could you extend mine-life there?

We are a producer, so we need to have resources in front of us to keep our production, and we have to drill every year. All of our capex and drilling goes to our all-in sustaining cost, so we do not want to overspend in drilling. Our Mexico's mine has had a four-year mine-life for over 10 years. At Coricancha, once we get into the mine, we will have an opportunity to transfer more of the remaining resources to the mine plan for phase II, while we will also be able to drill underground to increase the resource base.

What is your view of silver fundamentals?

Our business plan is not based on the silver price going up — we are making money at today's prices. Having said that, we think that silver has a strong industrial demand, as well as a strong physical demand for jewelry and silverware. Last year we suffered on the investment demand side of silver, but we think that silver has upside on the price, and the consensus forecast around the world is US\$18/ounce for the medium term. The gold-silver ratio of 80 to 1 is too high, it has historically been 65 to 1. We are not counting on it, but if the silver price goes up by US\$1, our margins will increase by approximately 30%. In any case, just restarting Coricancha will have a significant effect on our cash flow and our market capitalization.

It has been an interesting period for zinc producers, a field where Peru is ranked as the second largest player worldwide. Companywise, Antamina regained top spot in production in 2017 with a 69% increase in zinc output, representing 442,500 mt/y of zinc. The spectacular change is probably explained by the erratic nature of the geology in skarn deposits, as well as a conscious decision by the company to boost zinc output and take advantage of the recent high prices. Antamina's exceptional performance helped Peru's overall zinc production increase by more than 10%, to a total of 1.47 million mt/y.

Antamina is 33.75% owned by Glencore, that also recently took over a controlling stake in Volcan, Peru's second largest zinc pro-

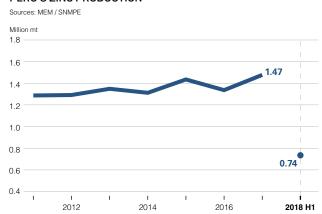
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PERU'S ZINC PRODUCTION



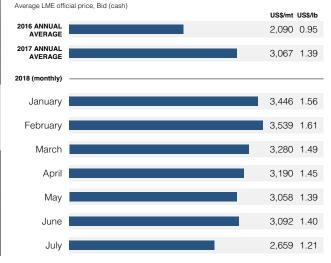
ducer with around 288,600 mt produced last year. Finally, Nexa Resources of Brazil (formerly Milpo-Votorantim Metais) produced 229,600 mt/y, the majority of which came from Cerro Lindo, Peru's largest underground operation.

Ricardo Porto, CEO of Nexa Resources, highlighted the importance of Cerro Lindo as the only operational mine in Peru currently using seawater for its process: "Cerro Lindo can be seen as a reference for how Nexa intends to mine, utilizing dry stack tailings and seawater that is completely re-circulated during the mining process. The long-term benefits of this are undeniable, not just for the environment, but also to create a parameter for future projects."

Porto added that extending mine-life at Cerro Lindo is the company's current focus, as the integration of the Atacocha and El Porvenir mines continues to drive efficiency at the Pasco complex. Looking ahead, although Nexa lost the public tender process for the Michiquillay copper project to Southern Copper, the Brazilian company has a significant pipeline in Peru, with projects like Shalipayco (zinc), and the Magistral and Pukaqaqa copper deposits.

ZINC AVERAGE PRICES

Sources: LME / GBR



44

PERU MINING 2018 Industry Explorations



Ricardo Porto

CEO
NEXA RESOURCES

The rebranding of Nexa was significant to integrate Milpo and Votorantim Metais. There were two motives for this: the first was to have a more robust, global structure and gain synergies. The second reason was to show a mining company moving in a new direction, specifically in the zinc

and copper markets.



Can you outline the rationale behind the rebranding to Nexa Resources?

A few years ago, as Votorantim Metais, we rethought our long-term strategy for the minerals and metals industry and it became clear that, due to the zinc fundamentals, zinc needed a different structure and focus to other metals that Votorantim worked with, such as aluminum and nickel (for which we created spin-off companies in 2016). Nexa Resources launched its IPO on the New York and Toronto stock exchanges in October 2017, at the same time as the new brand was presented.

The rebranding of Nexa was significant to integrate the different business entities of Milpo and Votorantim Metais. There were two motives for this: the first was to have a more robust, global structure and gain synergies in the relevant markets. The second reason for creating a new brand was to show a mining company moving in a new direction, specifically in the zinc and copper markets. Nexa, from the Latin word Nexus meaning union and connection, represents a company with eco-efficiency as its baseline, and we want to be seen as the benchmark for the next generation of mining development.

How are Nexa Resources' main operations in Peru performing?

In 2017, Cerro Lindo produced a total of 283,000 tonnes (mt) of zinc equivalent. The Pasco unit, that includes El Porvenir and Atacocha operations, produced a total of 125,200 mt Zn eq. Cajamarquilla, the seventh largest zinc refinery in the world and the largest in Latin America, produced 310,000 mt of metallic zinc in 2017.

In 2018 we are performing slightly above expectation, with potential for additional growth. We are increasing the parameters for exploration in the Cerro Lindo region and applying for new drilling licenses. Extending the mine-life of Cerro Lindo is the current focus. In the Pasco region, the integration of Atacocha and El Porvenir will add great value to the project, reducing costs and increasing mine-life. As the Cajamarquilla refinery is located only 37 km from the port of Callao in Lima, it is in a prime location logistically.

What is Nexa Resources' approach to community relations and environmental sustainability?

Nexa Resources intends to be at the vanguard of the movement towards more responsible, sustainable mining. Cerro Lindo can be seen as a reference for how Nexa intends to mine, utilizing dry stack tailings and seawater that is completely recirculated during the mining process. In the short term, these options are more expensive than traditional alternatives, but the long-term benefits are undeniable, not just for the environment, but also to create a parameter for future projects.

What are the key projects in Nexa Resources' pipeline?

Nexa Resources has five upcoming greenfield projects in Peru –Shalipayco, a zinc deposit, to be in operation from 2021; Magistral, a copper deposit, from 2022; Pukaqaqa, another copper deposit, from 2023; Florida Canyon and Hilarión, both zinc deposits, whose dates are still to be determined. The rate of replenishment of Nexa Resources' reserves has always been superior to our production, and the quality of our current projects and pipeline will ensure this continues.

How can formative change be applied in a traditionally conservative sector such as mining?

There are few business sectors where the need for change and innovation is as great as in mining. It is labor intensive and, due to the nature of current and future mining projects that require complicated engineering to extract minerals and metals at greater depths and in more remote locations, an increasing level of automation is necessary. New technology will also reduce the risks that go along with mining in such conditions.

In addition to technological development, improvements must be made with the interaction and communication between mining companies and the local communities, to ensure all parties reap the long-term benefits a mining operation can provide. Technological advances in other industries, such as the vast increase in the production of electric cars, will trigger a greater demand in the global metals market, and this will have a huge positive impact on the environment. If there is one thing we can guarantee for the future of mining, it is that change will be the only constant.

Other

Base Metals

Lead, molybdenum, tin... Peru has most of the world's important mineral commodities

In other base metals, Peru's lead production decreased by 2.4% to 306,800 mt, and tin production from Minsur, the country's only producer, also decreased by 5.3% (total output was 17,800 mt/y), a trend that should be

reversed by the company's US\$200 million B2 project to reprocess the tailings of San Rafael's operation. "B2 will add 5,000 mt/y of refined tin at a very high margin. It will increase our production profile by 20% to 30% through 2028 or 2029," said Juan Luis Kruger, CEO of Minsur.

Meanwhile, Peru's production of molybdenum increased to 28,100 mt/y in 2017. According to the United States Geological Survey (USGS), Peru ranks as the fourth largest lead producer and the fourth largest molybdenum producer globally.

Finally, iron ore production saw a 15% increase to 8.8 million mt, driven mainly by Shougang's ongoing expansion at Marcona, while Shouxin, a joint venture company between Baiyin and Shougang, produced 138,000 mt of iron ore through the reprocessing of Shougang's tailings, yielding some copper as well. Shouxin has a plan to double capacity by 2020, and it also plans to start recovering zinc during the second half of 2018.

After two years of low iron ore prices, we feel that the time is right to restart activity at our Apurimac project. There are studies for a new railway from Andahuaylas to San Juan de Marcona, which would open up the region to mining opportunities. Our Apurimac project is a very unusual magnetite skarn deposit with an exceptionally high average grade of 57% iron, very soft material that makes it easy to crush and grind, and a very low strip ratio.



- William Johnson, managing director, Strike Resources



CRII

Peru Metals & Mining Summit 2018

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CRU is pleased to announce a new one day summit to take place in San Isidro, Lima, Peru. The inaugural Peruvian mining summit will welcome a diverse audience from across the mining supply chain to discuss market issues and opportunities, and to facilitate business networking.

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- The outlook for the new energy economy globally
- CEO and CFO panels on the new energy economy, costs, finance and supply side opportunities
- The role of the Andean mining industry as a supplier to this sector
- Which base and minor metals offer the best investment opportunities and why?
- An analysis of price support levels, relative grades, input prices, projects, costs and margins, across countries and commodities
- The indirect impact of cobalt mining on the copper sector
- The outlook for project finance in these sectors

Confirmed speakers:

- Luis Rivera, President, Instituto de Ingenieros de Minas del Perú (IIMP)
- Ricardo Porto, CEO, Nexa Resources Peru
- Juan Luis Kruger, CEO, Minsur
- Joe Bormann, Managing Director, Deputy Regional Group Head, Corporate Ratings, Fitch Ratings
- José Carlos del Valle, VP Administration and Finance, Antamina
- Raúl Jacob Ruisánchez, Vice President of Finance and CFO, Southern Peru Copper Corporation
- Ricardo Labó, Ex Vice-Minister of Mines. Government of Peru
- Juan Esteban Fuentes, Head of South America, Consulting, CRU
- Ben Jones, Managing Consultant, CRU

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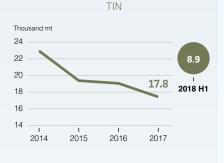
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Yuan Jiγu





MOLYBDENUM Thousand mt 28 25 29 19 16 13 2014 2015 2016 2017



How was the Shouxin joint venture formed?

Minera Shouxin Perú is a joint venture company invested by Baiyin Nonferrous Group and Shougang Hierro Perú, with shares of 51% and 49% respectively. Baiyin Nonferrous Group, headquartered in China's Gansu province, is specialised in the production of non-ferrous metals. Besides its investment in Peru, Baiyin Group also owns gold mines in South Africa and DRC. Meanwhile, Shougang is the largest producer of iron ore concentrate in Peru and every year it produces a great deal of tailings, containing valuable elements, like copper, zinc and iron. Shouxin is dedicated to recover these metals from tailings.

Could you provide some facts and figures about the project?

The total capital investment of this project was US\$230 million. The processing capacity of the benefication plant is 6.8 million mt/y. The estimated service life of this project spans 30 years. We currently pro-

duce 20,000 mt of fine copper in concentrate and 400,000 to 500,000 mt of iron ore concentrate per year. The plant was originally designed to produce zinc concentrate as well, but we have not started producing zinc yet since we are doing some relevant tests. We expect to start the production of zinc concentrate over the second half of 2018.

Do you expect to build similar projects in Peru, processing tailings from other mining producers?

We are currently looking for new opportunities to process tailings from other mining companies and we are in negotiation with some parties. Peru is a large mining country that produces a mass of tailings with different characteristics each year and many of them can be comprehensively utilized. The government is favorable to remediation projects that would reuse old tailings to have new production. However, for the time being, there is not a public policy to incentivize these investments. There should be tax incentives to these projects, because they help environmental remediation in a sustainable and economic manner.

How important are the Chinese-Peruvian commercial relationships?

Peru and China need each other. Peru has great potential for natural resource exploitation, but investment is needed. Chinese companies have capacity to invest. It is a positive bilateral relationship. The current investment climate in Peru's mining industry is very good.

What are the next steps for Shouxin?

We are going to use the existing resources to expand our operation in Marcona: we have an expansion project to double our production by 2020. We are going through relevant procedures for the approval of the modified EIA and the relevant permits to start construction. Besides, we would like to invest in a smelting plant in Peru. We are currently looking for producers of copper concentrate that want to have long term cooperation, because the copper concentrate that we produce at Shouxin is not enough to justify an investment in a smelting project.

PERU'S MAIN MINES

NUMBER	MINERAL	COMPANY	MINE
1	Copper, Molybdenum, Silver, Lead, Zinc	Antamina (BHP-Glencore-Teck-Mitsubishi)	Antamina
2	Copper, Molybdenum, Gold, Silver	MMG	Las Bambas
3	Copper, Molybdenum, Silver	Southern Copper	Cuajone
4	Copper, Molybdenum	Southern Copper	Toquepala
5	Copper, Gold, Silver	Glencore	Antapaccay
6	Copper, Molybdenum	Cerro Verde (Freeport-Sumitomo-Buenaventura)	Cerro Verde
7	Copper, Silver, Lead, Zinc	Nexa Resources	Cerro Lindo
8	Copper, Silver, Lead, Zinc	Nexa Resources	El Porvenir
9	Copper, Silver, Lead, Zinc	Nexa Resources	Atacocha
10	Copper, Silver, Lead, Zinc	El Brocal (Buenaventura)	Colquijirca
11	Copper, Gold, Silver	Southern Peaks Mining	Condestable
12	Copper, Molybdenum, Silver, Lead, Zinc	Chinalco	Toromocho
13	Copper, Silver, Lead, Zinc	Sierra Metals	Yauricocha
14	Copper, Silver, Molybdenum	Hudbay Minerals	Constancia
15	Gold, Silver	Yanacocha (Newmont-Buenaventura-Sumitomo)	Yanacocha
16	Gold	Barrick	Lagunas Norte
17	Gold, Silver	Barrick	Pierina
18	Gold, Copper	Gold Fields	Cerro Corona
19	Gold, Silver	Buenaventura	Orcopampa
20	Gold, Silver	Caraveli	Chacchuille
21	Gold, Silver	Coimolache (Buenaventura-Southern-Espro)	Tantahuatay
22	Gold, Silver	La Zanja (Buenaventura-Newmont)	La Zanja
23	Gold, Silver	Tahoe Resources	La Arena
24	Gold, Silver	Tahoe Resources	Shahuindo
25	Gold	C.M. Horizonte	Parcoy
26	Gold, Silver	Retamas	Retamas
27	Gold, Silver	Laytaruma	Laytaruma
28	Gold, Silver	Aruntani	Andrés
29	Gold, Silver	Anabi	Valeria
30	Gold, Silver	Apumayo	Apurimac
31	Gold, Silver	Minsur	Pucamarca
32	Gold, Silver	Poderosa	Poderosa
33	Gold, Silver	Buenaventura	Tambomayo
34	Gold, Silver	Titan	Belén
35	Gold	Minera IRL	Corihuarmi
36	Silver, Zinc, Lead	Buenaventura	Uchucchacua
37	Silver, Gold	Buenaventura	Julcani
38	Silver, Gold	Hochschild	Inmaculada
39	Silver, Gold	Hochschild	Pallancata
40	Silver, Gold	Hochschild	Arcata
41	Silver, Lead, Zinc, Copper	Pan American Silver	Huarón
42	Silver, Zinc	Pan American Silver	Morococha
43	Silver, Lead, Zinc	Fortuna Silver	Caylloma
44	Silver, Lead, Zinc	Volcan (Glencore)	Cerro de Pasco
45	Silver, Lead, Zinc	Volcan (Glencore)	UAE Chungar
46	Silver, Lead, Zinc	Volcan (Glencore)	UAE Yauli
47	Lead, Zinc, Copper, Silver	Glencore	Yauliyacu
48	Zinc, Lead	Trafigura	Catalina Huanca
49	Silver, Lead, Zinc	Casapalca	Americana
50	Silver, Lead, Zinc	Colquisiri	María Teresa
51	Lead, Zinc	Mitsui	Santa Luisa
52	Lead, Zinc, Silver	Buenaventura	Mallay
53	Zinc, Lead, Silver	Trevali	Santander
54	Zinc	San Ignacio de Morococha	San Vicente
55	Copper, Silver, Lead, Zinc	Raura	Raura
56	Iron	Shougang	Marcona
57	Phosphate	Mosaic-Mitsui	Bayóvar
58	Tin	Minsur	San Rafael
59	Copper	Anglo American-Mitsubishi	Quellaveco (under construction)
60	Copper	Minsur	Mina Justa (under construction)

PERU MINING 2018 Industry Explorations





Image courtesy of Regulus Resources



The Gold Production Solution

Peru offers opportunity for those juniors looking at generating their own cash flow

While Peru's copper segment offers significant exploration projects being advanced by junior companies, in gold there are no large junior-held projects in the pipeline, and most of the exploration activity is related to early stage projects or small mining operations by companies that decided to move into production.

One such is PPX Mining, that has an extensive bulk sampling program ongoing from the Callanquitas structure at the Igor project in La Libertad. Over the last year, the company has mined 25,000 mt of bulk sample, which has been processed at a nearby toll milling facility. "This has given us reams of hugely valuable data, such as information on recovery, grade distribution, and ore control

underground. In addition, we have received geotechnical and engineering information from the working faces at the mine – what stope designs and orientations to use, which size ramps work the best, and at what cost", declared Brian Maher, president and CEO of PPX Mining.

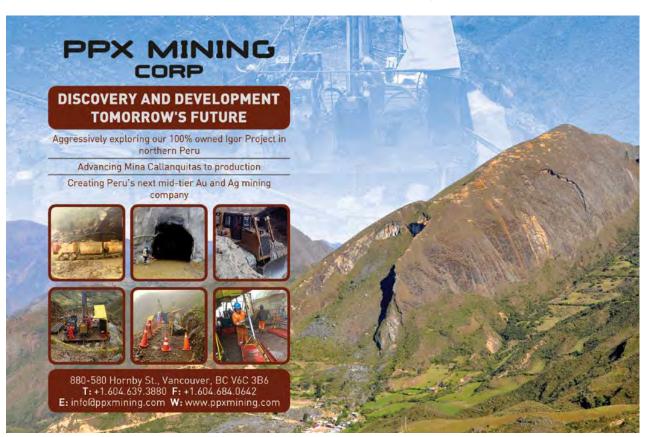
Maher said that so far, bulk samples have averaged a grade close to 8.5 g/mt, and that that all the data gathered will help the company make an informed decision to go into production. An upcoming pre-feasibility study will evaluate the economics of a 350 mt/d underground mine, using a heap leaching process to recover gold and silver.

Following a similar model, Lupaka Gold has been focusing its efforts on Invicta, a gold-copper polymetallic underground project. The company's plan is to start mine development, use a contract miner and then send the ore to a toll milling facility for processing, generating cash flow for investors.

Sampling from vertical raise development is already under way, and commercial production is expected this year.

Will Ansley, CEO of Lupaka Gold, gave more details about the company's plans: "We intend to operate at an initial 350 mt/d. We have an initial mine plan which outlines a six-year mine life. By 2019, we will have another updated resource with an expanded concept of between 500 and 1,000 mt/d. Investing in our own plant on-site would allow us to double or triple production."

Meanwhile, in the Ancash region, Eloro Resources is completing its second phase of drilling at La Victoria, consisting of 4,000 meters. Tom Larsen, chairman and CEO of Eloro Resources, said: "At Phase I we defined a significant low-sulfidation epithermal system at the Rufina sector of La Victoria. Phase II will focus on newly discovered gold-bearing structures and how these are related in the different sectors."



PERU MINING 2018 Industry Exploration



Brian Maher

President and CEO **PPX MINING**

The PFS will contain a brand new resource estimate for the Callanquitas structure encompassing all the new drilling, and will evaluate the economics of a 350 mt/d underground mine, feeding a company-owned processing facility that will use heap leaching technology to recover gold and silver.



Could you summarize the main highlights for PPX since its rebranding from Peruvian Precious Metals in 2016?

Since 2016, the company has made a huge transition. We commenced test mining and bulk sampling on the Callanquitas structure at the Igor project in November 2016. Since July 2017, PPX has mined and processed over 25,000 mt of bulk sample. That material is processed in a nearby toll milling facility. This has given us reams of hugely valuable data, such as information on recovery, grade distribution, and ore control underground. In addition, we have received geotechnical and engineering information from the working faces at the mine.

All this real-life data will help us make an informed decision to go into production, via the pre-feasibility (PFS) process. By taking large samples from inside the existing defined inferred resource, we can verify the drilling that has taken place. We utilize both the bulk samples themselves, which have averaged almost 8.5 g/mt, and also the samples taken from the working faces. Besides the test mining and bulk sampling, a thorough infill and resource expansion drilling campaign has been completed at Callanquitas, with great results.

Can you elaborate on the progress at other areas of the Igor project?

In addition to Mina Callanquitas, PPX has made a new discovery at Portachuelos. Our intercepts include 45 meters of 2.7 g/mt gold equivalent, right near the surface. While it is "lower grade", from a bulk and surface mining stand point, it is actually quite spectacular. The first phase of drilling has just been completed, and the system has been outlined over a strike length of almost 1,200 meters, to a depth of up to 350 meters. Portachuelos consists of multiple parallel breccia zones, five of which have been identified.

PPX's third exploration target area at Igor is Tesoros, an area with historic drilling totaling 1,200 meters including a drill hole that hit 75 meters of 4.5 g/mt gold equivalent within 50 meters of the surface. This has never been followed up and the area has huge potential. The Igor project is becoming not just the story of Mina Cal-

lanquitas, but it is evolving into a district scale project, with multiple deposits.

What results does PPX expect from its upcoming pre-feasibility study?

The PFS will contain a brand new resource estimate for the Callanquitas structure encompassing all the new drilling, and also an analysis of what economic development is appropriate. The PFS will evaluate the economics of a 350 mt/d underground mine, feeding a company-owned processing facility that will use heap leaching technology to recover gold and silver. Metallurgical testing has shown that in column leach tests, which are used to mimic the heap leach process, recoveries of up to 90% are possible. When you do a trade-off analysis between the capital cost of building a full milling facility and then recovering through CIP or CIL, versus a heap leach, you have much lower capex and opex. We are in the process of permitting this facility, and we expect it to be up and running by the end of October 2018.

How are relations between PPX and the local communities in the Igor area?

At Callanquitas, a beautiful agrarian community at 3,300 meters in the Andes, PPX and its predecessors have been exploring for 10 years, and we have had exploration agreements in place the whole time. In February 2018, we renewed our agreement, which allows PPX to mine and explore in the Igor project for a 10-year period.

What will be the key highlights for PPX in 2018?

Two of the big milestones will be receiving the permits to build the processing plant, and completing the PFS. Further development of the project will follow – constructing the processing plant and ramping up the mine. PPX will continue drilling campaigns at Portachuelos, which will give us a better idea of the size and geometry of the mineralization. We are also very excited to get the drill rig over to Tesoros. The game plan is to execute on the mine development side, while continuing to aggressively explore the project to understand the ultimate size of the gold and silver resource at Igor. ■

Will Ansleγ

President and CEO LUPAKA GOLD



What attracted you to Lupaka Gold?

What attracted me to the company was the location of the assets in a pro-mining country like Peru, the existing infrastructure and the grades and widths at the Invicta gold development project. The width of the ore body at Invicta is eight meters on average, which would allow for a fairly straightforward mining operation with low startup costs. The average grade is quite robust and gold represents approximately around 65% of the expected revenue; the rest is split almost equally between copper, silver, zinc and lead. Our plan is to produce three separate concentrates from Invicta.

What is the defined resource so far and what do you think is the upside potential?

As part of the preliminary economic assessment (PEA), we are going to update the resource to match our startup strategy and the current metal prices. We intend to operate at an initial 350 mt/d. We have an initial mine plan which outlines a six-year mine life, utilizing the existing infrastructure and covering a height of 130 meters, with a further

150 meters above. At the surface, we have the same widths and grades so we are pretty confident that with the initial plan, we will actually be mining for at least 12 years or more. By 2019, we will have another updated resource with an expanded concept of between 500 and 1,000 mt/d. Investing in our own plant on-site would allow us to double or triple production.

What is your financial position and what was the importance of selling the Crucero gold project?

Our current cash position is US\$3 million, however we have secured a total of US\$7 million through forward gold sales of a portion of gold production to Pandion Mine Finance. As part of the agreement, the Company was to raise an additional US\$2 million from any source, so we chose to sell our Crucero project to GoldMining Inc. At Crucero, we were able to drill off in excess of 2 million ounces of gold. However, it is at a high altitude and has a sizeable royalty. This sale made sense to us because it meant we were able to focus all our efforts and capital on Invicta, our flagship asset.

Tom Larsen

Chairman and CEO **ELORO RESOURCES**



Could you give us an update about Eloro's recent activities?

We completed a 2,200-meter maiden drill campaign in 2017 in the Rufina sector of the La Victoria gold/silver project. Our technical team was successful in proving up the epithermal model there. We are drilling an additional 4,000 meters in 2018. We will focus on additional mineralization discovered in the Victoria South and Ccori Orcco sectors. We are also looking at the north-west corner of La Victoria, called San Markito, which is a breccia in the Chimu sandstone formation higher up in the La Victoria epithermal system, near the community of Pallasca.

What is your impression of the results of the first campaign?

This is a big program, considering we have 90 square kilometers of drillable land. Most of the previous work done was artisanal. With the Phase I drilling program we defined a significant low-sulfidation epithermal system. Phase 2 drilling will focus on newly discovered gold-bearing structures and how these are related. Our technical advisors have shown that the epithermal system at La Victoria is approximately 1.5 km in vertical extent and over 3 km in horizontal extent.

Have political changes in Peru brought increased uncertainty?

Peru has a very strong mining culture with solid operators and, because of this, you will find that political changes do not affect the mining industry much. Peru's GDP relies primarily on mining and thus there is great respect for the industry from a political standpoint. Peru is one of the most attractive destinations to be in in South America when it comes to mining in part because of recent changes in laws and permitting.

Do you have the feeling that the markets are improving?

It is still tough for junior companies to raise money from the retail base. The bottom line is that you still need a strong technical team. We are confident with our team and our land position with the La Victoria gold/silver project. This, coupled with the low operating costs in this area and world-class mining neighbours, helps us raise awareness of the potential of La Victoria. Our next steps will be proving up our epithermal model in Rufina through to Ccori Orcco, Victoria South and San Markito, and come in with a solid initial resource.

54

PERU MINING 2018

Copper Excitement

The last cycle saw a wave of M&A for copper projects in Peru. Some believe this process is about to start again

In June 2018, some mining executives could not hide their excitement at the announcement that South32 was acquiring Arizona Mining for US\$1.3 billion. While this is not a copper asset, it shows a heating trend in mining-related M&A activity, which, according to Bloomberg, has actually been increasing in 2016 and 2017.

In Peru, while the country continues to cement itself as the second largest producer of copper in the world, a number of exploration projects gather pace across the country, with the expectation that the major mining houses will sooner or later take them over, as happened in the past with Constancia, Toromocho and Haquira.

After spinning out its Argentinean assets into a new company called Aldebaran Resources, Regulus Resources continues to focus on its AntaKori copper project in Cajamarca, northern Peru, located immediately next to the Tantahuatay gold-silver mine. AntaKori has a 43-101 resource of 295 million mt at 0.48% copper, 0.36 g/mt of gold and a little more than 10 g/mt of silver. Regulus' campaign for 2018 will be approximately 18,000 meters of drilling, and the company has already released the results of twelve holes. John Black, CEO of Regulus, said: "Much of our initial drilling at AntaKori has focused on the southern margin of the previously known mineralization and results to date have significantly extended mineralization in this direction."

Regulus wants to use the current campaign to update the resource estimate, however John Black warned that it will take more time than that to realize AntaKori's full potential: "AntaKori is a very large project and we must be patient to fully capture the opportunity."

Meanwhile, Kaizen Discovery has continued to focus on its Pinaya project, located between Arequipa and Puno. Pinaya, previously explored by AM Gold and Rokmaster Resources, sits in the same belt as Glencore's Tintaya deposit and presents typical skarn and porphyry copper-gold mineralization. After some delays created by the Peruvian government's prior consultation process with the local communities, Kaizen's drill program this year will have two primary components, according to Kaizen's president and CEO, Tom Peregoodoff: to extend the resource laterally and to explore the potential of some deeper areas.

The company is also planning to drill one new target called Pedro 2000, which was identified through both existing geophysics and some ground mapping. The program has a total budget of US\$5 million, jointly funded by Kaizen's partners, Itochu 58 >>

For Pecoy, we hired several engineering companies to complete a power line study, a road study for access to the coast, a water well study that has provided positive results for a pumping station from the gravels, and a tailings and waste dump study. What is remaining is the pit scheduling, which will be done over the next months.

- Brian Booth. president and CEO, **Pembrook Copper**

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Industry Explorations PERU MINING 2018

Tom Peregoodoff

President and CEO

KAIZEN DISCOVERY

What is your exploration focus at Pinaya this year?

Pinaya sits in between Arequipa and Puno, in the same belt as Tintaya. Some of the mineralization is typical of what you would expect in a skarn deposit, and also the typical copper-gold porphyry mineralization of that area. While Pinaya is a known project with a significant resource, the majority of the work has been directed to that resource area. Due to this, there are portions of the property that



are yet to be covered with advanced geophysical techniques.

This year's drill program has two primary components: first, to see if we can extend the resource in a lateral sense, and secondly, to target some deeper areas that we believe may have potential. We are also planning to drill one new target called Pedro 2000 that we identified through both existing geophysics and ground mapping. The program has a total budget of US\$5 million, jointly funded by our partners, Itochu of Japan.

Could you explain about the Typhoon technology owned by HPX, Kaizen's major shareholder?

HPX has a proprietary exploration technology called Typhoon, which enables the user to penetrate much deeper into the ground. This is especially important in areas where you have resistive cover. As part of our arrangement with HPX, not only do we have the ability to use Typhoon in the Pinaya project, but we can also take this technology to any other project. Indeed, a big part of our focus over the last months has been to identify and secure additional exploration opportunities, primarily focused in copper and gold in Argentina and Peru. Individuals that we have been speaking to find the proposition of having the Typhoon technology deployed on their properties very attractive.

How do you read the current copper fundamentals?

The copper price is going to continue to strengthen. Probably we will not see the frantic price increases that we had in the past, but the copper fundamentals are very strong.

David Kelleγ

President and CEO
CHAKANA COPPER

How did you decide to form Chakana?

After leaving MMG in 2016, I was introduced to Tom Wharton and Juan Valdivia. We all had the common interest in forming a discovery-focused company in Peru. Because of my previous experience in the region, I had shortlisted the Soledad project; therefore, we signed a 100% purchase option agreement with Condor Resources in April 2017 and started drilling in August 2017. Upon completion of the reverse takeover with Remo Resources, trading commenced on January 31, 2018, which the market received very well. This reflects the fact that the copper market is really strong right now and that there is a shortage of high-grade cop-



per projects in favorable jurisdictions. Soledad is high-grade and Peru is a great place to be.

What was the previous history of the Soledad project before Chakana's arrival?

Previously, Condor carried out some basic exploration mapping and sampling. Mariana Resources continued extensive work in geophysics, mapping, sampling and drilled 12 drill holes with very interesting results. After Mariana, Casapalca drilled four additional holes. The strategy of all these companies was to find a porphyry deposit that is assumed to be related to the tourmaline breccia pipes. Our view is different. We think these

high-grade breccia pipes can offer significant economic value because they are numerous, high-grade, vertically extensive from surface, and are relatively easy to explore.

What have been the highlights of your drilling activity so far?

Highlights from our first few holes in Breccia Pipe #1 include 146.6 meters with 2.51 g/mt Au, 48.6 g/mt Ag and 0.77% Cu, and 209 meters with 2.22 g/mt Au, 69.6 g/mt Ag and 0.96% Cu, both from surface. Additional holes have similar grades but the lengths vary as we are drilling various azimuths and dip angles to define the geometry of the pipe. We are in the beginning of a very aggressive program and it will take us approximately two years to go through all the pipes. So far we have identified nine mineralized breccia pipes that crop out at surface. We certainly believe that the potential exists for enough tonnage with attractive copper-gold-silver grades to develop a mining operation.

What other projects in Peru or the region compare to Soledad?

A similar type of deposit is the Turmalina mine in Peru. It is a tourmaline breccia pipe

Global Business Reports

As you start to look at more electrification at different segments of society, especially transportation, and with continued economic growth in the developing regions around the world, the demand fundamentals that underpin everything are going to continue to be very solid.

Has Peru seen its attractiveness damaged in light of the political noise earlier this year?

I think there is a lot of political uncertainty in Peru right now. The markets are very aware of all this, so from that perspective the country's attractiveness may have decreased a little bit if you compare it to Chile. Also, there are certain communities within Peru that remain decidedly anti-mining, but we cannot look at Peru with one broad brush. We just need to make sure that we focus our investments on the regions that are more willing to work together with mining development companies. From a geological perspective, and with the higher prices of copper, Peru is an extremely attractive country, and it is not as mature as other parts of the world, like Chile.

that had very high-grade copper in one margin that has been mined out. The best examples of this deposit type are in Chile, in the Río Blanco-Los Bronces district. Los Sulfatos, a discovery by Anglo American, is enormous in scale with 1.2 billion tonnes (mt) at 1.46% copper. There is also the Sur-Sur and Donoso breccia bodies with the same exact style of mineralization as we see in Soledad. Because a project like Soledad does not have a large footprint, it does not have the environmental and social impacts of a huge lowgrade deposit that takes years to drill out. It is a very compact project in a good mining area. We can move along quickly, which is very important in a cyclical industry like mining.

What is your focus for 2018?

We have an expanded drill program this year and by the end of 2018, we should have enough information to put together our first resource covering at least two pipes. The pipes crop at surface but are steep, cylinder-like bodies so it takes a significant amount of drilling to properly understand the mineralization, tonnage, and grades. We are also working on the mineralogy and initial metal-lurgical tests.



John Black

CEO
REGULUS RESOURCES

What is the latest update from the Anta-Kori project?

Drilling continues to go well at the AntaKori project with three drill rigs turning. We have reported 16 drill holes to date and we are very encouraged by the results. Our initial hole encountered 184 meters with 1.54% copper and 1.05 g/mt gold, and results from subsequent holes include an interval of 524 meters with 0.65% copper and 0.47 g/mt gold. Our recently reported hole AK-18-010 intercepted 327 meters with 0.91% Cu, 0.44 g/mt Au and 9.8 g/mt Ag from 293 meters depth with lengthy intercepts. When we see over 100 meters with more than 1% Cu with significant gold and silver and low arsenic contents we know we are well on our way to uncovering a new well-mineralized skarn/porphyry deposit under the high-sulfidation epithermal zone. Much of our initial drilling has focused on the southern margin of the previously known mineralization and results to date have significantly extended mineralization in this direc-

The current reported resource for the Anta-Kori project is based on two drill campaigns by previous operators with an estimated inferred resource of 295 million mt with a grade of 0.48% copper, 0.36 g/mt of gold and a little more than 10 g/mt of silver. We anticipate that the results from our current drilling campaign will add significant resources at AntaKori.

What are the possible synergies you are undertaking with the Tantahuatay project?

Our project is immediately adjacent to Coimolache's Tantahuatay mine, which is a joint venture between Buenaventura (operator), Southern Copper and Espro. Due to the complex land situation and the fact that mineralization crosses our property boundaries, we have a number of agreements in place, including a collaborative exploration agreement. We share data and work collaboratively to complete exploration plans but have been careful to maintain our autonomy in the process.

What is the current plan for 2018's drilling campaign?

Our current campaign will be approximately 20,000 meters of drilling, which will double what has previously been completed at the project. We have completed approximately 14,000 meters to date, and we should complete the program by Q3 2018. At this point, we will use the data to produce an updated resource estimate at the start of 2019, but we will also continue drilling aggressively with three or more drill rigs. Both the skarn and the high sulfidation epithermal copper-gold sulfide mineralization present at our site are characterized by having high but variable grades and remain open in most directions. Because of this, the project will require two to three years of extensive drilling for us to demonstrate the full potential of the deposit.

Do you think there is potential of porphyry mineralization at depth?

The skarn mineralization at AntaKori is a style of mineralization often associated with porphyry systems. Peru is one of two countries globally, along with Indonesia, with extremely large skarns, like Las Bambas and Antamina. At AntaKori, we anticipate that we will find a mineralized porphyry driving the system at some point. We are yet to intersect that, but we have encountered mineralized porphyry fragments within breccias cutting skarn mineralization, indicating the probable presence of nearby mineralized porphyry bodies.

The AntaKori project represents an opportunity to define a very large resource of Cu-Au-Ag mineralization at a time when deposits like this are becoming increasingly hard to find. We anticipate that major mining companies will be aggressively pursuing the acquisition of deposits like this in the next few years, which makes Regulus an attractive investment opportunity.

Industry Explorations PERU MINING 2018

of Japan, who will be earning a 20% participation in the project. "We expect this drill campaign will lead both to a second phase of drilling and to an increase in the resource," said Peregoodoff.

Peru's dynamic junior sector and its positioning as the best upcoming destination for copper exploration has helped attract other companies in this space. Newly-arrived Chakana Copper, a company that started trading on the TSX-V end of January, is focusing on the Soledad project located in Ancash. Interestingly enough, Chakana is not targeting yet another large open-pittable deposit at Soledad, but is focusing on defining the potential of its high-grade pipes instead.

According to David Kelley, president and CEO of Chakana Copper, it should take Chakana two years to go through all the pipes, but this year they could have an initial resource estimate already. He explained: "Because Soledad does not have a large footprint, it does not present the environmental and social impacts of a huge low-grade deposit that takes years to drill out. It is a very compact project in a good mining area. We can move along quickly,

which is very important in a cyclical industry like mining."

Meanwhile, Panoro Minerals continues its exploration efforts at its flagship Cotabambas project. On the M&A front, the company recently sold the Kusiorcco property to Hudbay Minerals for US\$5 million plus a 2% NSR royalty, and now it would also like to divest its Antilla project, for which an updated preliminary economic assessment (PEA) has been released.

Luquman Shaheen, president and CEO of Panoro, provided some highlights about Antilla: "As an investment option it is low-risk because the capital cost, at only US\$250 million, is low. Moreover, the net present value of the project is higher than the capital cost, the capital intensity and the cash costs are low, the footprint is small, and no community relocations are required. 98% of the resource that is in the mine plan is already at the indicated category, therefore minimal infill drilling is required, so there is as a shorter runway to feasibility and development."

With regard to Cotabambas, the company is focused on testing satellite targets. "There is great potential for the project to see a significant increase in higher-grade resources and oxide resources [...] Following this, the next step will be the skarn mineralization located in Cluster 2," Shaheen concluded. Finally, privately-owned Pembrook Copper continues advancing its Pecoy copper project in southern Peru, with a current resource of 644 million mt at 0.334% Cu, using a 0.25% Cu cut-off grade. Pembrook owns 51% of the project and can get to 80% ownership by completing a feasibility study and making a cash payment. The company is currently focusing on the engineering studies at a preliminary economic assessment level. "We hired several engineering companies to complete a power line study, a road study for access to the coast, a water well study that has provided positive results for a pumping station from the gravels, and a tailings and waste dump study. What is remaining is the pit scheduling, which will be done over the next months," explained Brian Booth, president and CEO of Pembrook Copper.

In parallel to this, the company is also exploring a second porphyry copper project in the same area, called Tororume, which is 100%-owned by Pembrook.



58



We would like to sell the Antilla project this year. As an investment option it is low-risk because the capital cost, at only US\$250 million, is low, and the net present value of the project is higher than that. Moreover, the cash cost is low, the footprint is small, and no community relocations are required. 98% of the resource in the mine plan is already at the indicated category, therefore minimal infill drilling is required, which provides a shorter runway to feasibility and development. I believe Antilla is worth US\$100 million right now.



- Luquman Shaheen, president and CEO, Panoro Minerals



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AN ATTRACTIVE MARKET FOR COPPER DEALS

COPPER PROJECT TRANSACTIONS IN PERU

Source: Various / GBR

Year	Project	Seller	Buyer	Transaction value (USD)
2005	La Granja	Peruvian State (Proinversión)	Rio Tinto	22 million
2006	Tintaya	BHP Billiton	Xstrata	750 million
2007	Rio Blanco	Monterrico Metals	Zijin Consortium	186 million
2007	Michiquillay	Peruvian State (Proinversión)	Anglo American	403 million
2007	Toromocho	Peru Copper	Chinalco	792 million
2008	Galeno	Northern Peru Copper	Jiangxi - Minmetals	453 million
2010	Mina Justa (70%)	Chariot Resources	CST Mining	248 million
2010	Haquira	Antares Minerals	First Quantum Minerals	468 million
2011	Constancia	Norsemont	Hudbay Minerals	523 million
2011	Magistral	Peruvian State (Proinversión)	Milpo	8 million
2011	Magistral	Inca Pacific Resources	Milpo	35 million
2012	Mina Justa (70%)	CST Mining	Minsur	505 million
2012	Quellaveco (18.1%)	IFC	Mitsubishi	825 million*
2013	Condestable	Trafigura Mining	Southern Peaks Mining	n/a
2014	Las Bambas	Glencore	MMG - Guoxin - CITIC	7 billion**
2016	Mina Justa (30%)	Kores - LS Nikko Copper	Minsur	85 million
2018	Kusiorcco	Panoro Minerals	Hudbay Minerals	5 million
2018	Mina Justa (40%)	Minsur	Inversiones Alxar	200 million
2018	Michiquillay	Peruvian State (Proinversión)	Southern Copper	400 million
2018	Quellaveco (21.9%)	Anglo American	Mitsubishi	600 million

*Approximate figure. Transaction was reportedly worth between US\$760 million and US\$890 million **US\$5.85 billion plus construction expenditures already incurred by Glencore Xstrata



EMERGING DISCOVERY AT ANTAKORI CU-AU-AG PROJECT

Extensive Drilling in Progress

18,000 m Phase 1 Program to be Completed by mid-2018

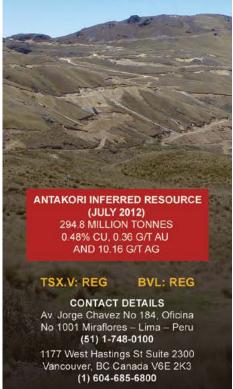
Updated Resource Estimate by late 2018

Experienced Team

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Zinc Exploration

Stronger metal prices have helped companies in this segment

The main junior company in Peru's zinc space is Tinka Resources, which updated its NI 43-101 resource estimate for its flagship Ayawilca project in Pasco, providing a 130% increase in the zinc resource. The new resource consists of 42.7 million mt with 5.6 billion pounds of zinc content (2.5 million mt Zn) as well as some indium, silver and lead. In 2018, Tinka is set to complete a 15,000-meter drilling campaign and will target new areas, including Zone 3 and Chaucha, as well as an extension of Central, South and West Ayawilca.

Graham Carman, president and CEO at Tinka Resources, said: "This drilling campaign will aim to add more high-grade resources to our portfolio and further improve the economics of the project. We will have a resource upgrade, and then we will complete our preliminary economic assessment (PEA) over the second half of the year."

Another company involved in zinc exploration and development is Zinc One, whose primary focus is to reactivate zinc production at the Bongará mine, following the company's acquisition of Forrester Metals The difference between the Zinc One approach and the previous Pacasmayo operation at Bongará is that they processed the ore on the coast, 540 kilometers away, which took away a lot of their margin through trucking costs, whereas we intend to process it on-site, through the installation of a Waelz kiln, which runs on anthracite coal.

- Bill Williams, COO,



Zinc One



Graham Carman

President and CEO
TINKA RESOURCES



Can you summarize the main milestones for Tinka Resources in the past year?

During 2017, we made a new discovery at our Ayawilca zinc project in central Peru at an area known as South Ayawilca. In December 2017, we published our updated NI 43-101 mineral resource estimate at Ayawilca of 42.7 million mt grading 7.3 % zinc equivalent, which was a 130% increase on the previous zinc resource. The resource now contains 5.6 billion pounds of zinc (2.5 million mt Zn) as well as 3,300 mt of indium, 23 million oz silver and 200 million pounds of lead. The project has fantastic exploration potential and we are drilling throughout most of 2018 to increase our resources.

Of the 42.7 million mt, 22.3 million mt is grading around 9.0% zinc equivalent from two areas at South Ayawilca and West Ayawilca, which have the highest grade and are the thickest and are also the shallowest parts of the deposit. As well as the increased tonnage over the previous resource, the grade also remains very attractive at over 6% zinc. So, the new resource strengthens Ayawilca's position as one of the biggest undeveloped zinc projects internationally.

Will you be carrying out further metallurgical tests this year?

We are doing tests right now, taking representative samples from all over the zinc deposit with the aim of understanding the variability of the metallurgy. At this moment, there are no red flags. Mineralization is all sulfide and generally quite coarse grained. Zinc (as sphalerite) is the dominant mineral, and pulls also the indium with it, so the zinc concentrate will represent well over 90% of the value of the deposit. We also plan to produce a silver-lead concentrate.

You also have a tin resource. How strategic is this given the global emphasis to use conflict-free tin?

Most of the world's tin comes from parts of the world like Myanmar, Indonesia and Malaysia where it is often mined illegally. We would like to develop our tin deposit as it will give the project more value and exposure to more metals. The tin lies deeper than the zinc so it will probably not be mined from the start, yet we would like to include the tin in our upcoming preliminary economic assessment (PEA) as the tin real-

60

PERU MINING 2018 Industry Explorations

in 2017. The company has been drilling in the area to bring the historical resource from previous mining operators to 43-101 standard. The mine was exploited most recently by Cementos Pacasmayo, and the company's plan is to be back in production by 2020. Bongará's zinc mineralization is high grade and heavily oxidized, hence Zinc One's strategy to set up a Waelz kiln on-site running on anthracite coal. Bill Williams, COO of Zinc One, gave more details: "The Waelz kiln provides an efficient process with low capital costs, and eliminates waste management expenditure. Thanks to the pyrometallurgical process, there are none of the typical tailings that mines have to deal with. The waste will be a slag, which is chemically inert and can be recycled and used for road aggregate."

ization is very high in terms of value. Our current tin resource is 10.5 million mt grading 0.7% tin equivalent containing 145 million pounds.

What has been the reception from local investment to your listing on the Lima Stock Exchange?

The reception has been positive although not a lot of shares are available in Lima as yet. It will take time to build a shareholder base and at some point we will raise money in Peru to get more liquidity in the local market. Zinc has hit an 11-year high (\$1.60/lb) and with the change in the local market, where Volcan has been absorbed by Glencore, and with Nexa possibly delisting from the Lima stock exchange, there is a shortage of quality zinc players. Tinka would be a very good investment alternative.

How do you think the zinc price will behave over the coming months?

At this moment, there are not a lot of big zinc mines coming to the market, and we have seen a number of large zinc mine closures such as Century in Australia and Lisheen in Ireland. The supply response may come from a few small mines that are only viable when zinc prices are high but, as yet, we have not seen a supply response from China, which has surprised many commentators. The demand for zinc is going to continue growing as well, due to its increased use in car manufacturing in China through galvanized steel, and there is a sleeper in the zinc space: zinc-air batteries are an alternative for lithium batteries in electric vehicles.





NOW DRILLING AT AYAWILCA IN PERU

Ayawilca Inferred Mineral Resource (November 2017)

Open in most directions

42.7 million tonnes grading 7.3% Zinc equivalent (6.0% Zinc, 0.2% Lead, 17 g/t Silver, 79 g/t Indium) (\$55/t NSR cut-off value)

10.5 million tonnes grading 0.70% Tin equivalent (0.63% Tin, 0.23% Copper, 12 g/t Silver) (\$55/t NSR cut-off value)

Targeting Resource Expansion Through 15,000-meter Drill Campaign in 2018



Grassroots is Back

More funds available give greenfield exploration a new life

Peru is certainly fertile ground for grassroots exploration. A common statement by junior company CEOs is 'This project has never been drilled' or 'This area has never been explored', or at least, 'Not explored using modern techniques', because millenary artisanal mining activities sometimes put geologists on the right path.

"There is a modern day gold rush underway in south-eastern Peru by informal miners that everybody is aware of, yet little to no modern day systematic exploration is under way," affirmed, for instance, Andrew Thomson, president and CEO of Palamina, a company that has staked a land package in the Puno orogenic gold belt in south-eastern Peru, with an initial focus in the Coasa and Gaban projects. "No one truly knows how much gold is being produced there, as large quantities cross the border and are sold to Bolivia," he said.

Thomson is confident that, albeit grassroots, the Coasa and Gaban projects can be advanced fairly quickly thanks to the team's experience in this belt, consisting of some former Minera IRL geologists who defined the Ollachea deposit in the area. Thomson continued: "At Gaban we have already identified slate shear zones very similar to the mineralized shear zones at Ollachea, where gold occurs in quartz and the metallurgy is very straightforward. Much of the gold in the belt is associated with pyrrhotite and can be located through magnetic survey, so we are planning to fly the Gaban project area to identify the best targets."

Meanwhile, Pucara Resources, a company formed in 2013 with the exploration team and early-stage projects of the former Esperanza Resources, had to survive the worst of the downturn in a market that did not have any money to offer for grassroots explorers. For that reason, Pucara relied partly on the prospect generator model, acquiring joint venture partners to fund exploration.

Today, the company counts Nexa Resources and Iamgold as partners, while it has recently closed financing with the support of Resource Capital Fund and Sandstorm that should allow Pucara to engage in substantial

Pucamayo is our more advanced project, both from a technical and a permitting perspective. It is an epithermal gold project and next to it we have identified a porphyry copper-gold area.

- Ever Márquez, VP exploration, Condor Resources



64 >>





PERU MINING 2018 Industry Explorations

6

Steve Zuker

CEO
PUCARA RESOURCES



How did you decide to form Pucara?

I was given the opportunity to purchase the grassroots assets Esperanza Resources had in Peru, where I had built a structure since 2005. We had to find joint venture partners to get through the difficult years of the market. In 2015, we raised C\$2 million through Resource Capital Funds (RCF), a private equity group. They bought 20% of the company's equity. In 2017 Sandstorm Gold bought royalties on seven of our properties in exchange for C\$1 million. They also acquired a 4% stake in the company.

With your recent C\$4.2 million financing, will you do your own drilling?

Our current joint venture partners are Nexa, who are drilling 4,000 meters on our Guadalupe VMS copper-zinc project, and Iamgold, who are exploring the Los Tambos project. Beyond that, RCF and Sandstorm want to see us drill, so Pucara is now following a "Hybrid Exploration" model whereby we will generate projects, but we will also drill some of them. This year we plan to drill our Lourdes and Pacaska gold projects. We will probably spend C\$750,000 at Lourdes, followed by another

C\$250,000 on geophysics at Pacaska. Then, by the end of the year we could spend C\$2 million on a second phase of drilling at Lourdes and a first phase drilling at Pacaska. We plan to list the company on the Toronto Stock Exchange in the fall, so, with good results and improving market conditions, we should be able to raise more money and continue exploration.

Were you able to grab interesting properties when exploration went down?

There was a lot of ground available. We identified some good targets and now we control more than 300 square km, mostly in the Ayacucho and Cusco regions. We are one of the few juniors doing grassroots exploration. Besides Lourdes and Pacaska, we are working on six more projects, none of which have ever been drilled. Of these, we want to sign joint ventures at our 100%-held Capricho and Paco Orco projects. Capricho is a porphyry copper prospect, and Paco Orco is a carbonate replacement deposit (CRD) target. At Pucara we want to stay focused on high-sulphidation, bulk-minable gold projects (over 1 million ounces), so we prefer to sign joint ventures on the base metals projects.

Andrew Thomson

President and CEO
PALAMINA



Could you develop on your current gold exploration activities?

Palamina has staked and acquired more than 70,000 hectares in the Puno Orogenic Gold Belt in Peru ('POGB'). There is a modern day gold rush underway in south-eastern Peru by informal miners, yet little to no modern day systematic exploration is underway. At Madre de Dios and La Rinconada you have more than 700 square kilometers being exploited by informal miners, which suggests that this area has the potential to host many world class gold deposits. To date, we have secured five district-scale gold projects within the POGB. The two that stand out are our Coasa and Gaban properties.

What is the geology looking like?

At Gaban we have already identified slate shear zones very similar to the mineralized shear zones at Minera IRL's Ollachea where gold occurs in quartz and the metallurgy is very straightforward with greater than 85% recoveries. Much of the gold in the POGB is associated with pyrrhotite and can be located through magnetic survey, so we are planning to fly the Gaban project area to identify the best targets. The other project, Coasa, is near the top of the Andean divide. In that district,

Lupaka drilled off a significant gold resource at Crucero, which Goldmining recently purchased. We are expanding our land position in the area and our next move there is also to run magnetics, locate the best mineralized structure(s), then go drilling.

What are the advantages and challenges of working in Peru?

Companies in Canada are reporting drill rates as low as C\$65 per meter while in Peru the rate is between US\$120 and US\$180/meter for similar terrain. Setting aside the highly prospective geology, where Peru is my favorite in the world right now, the country needs to reduce its drill costs. It also needs to reduce the red tape, because it takes a long time to get anything done and operating public companies is much more expensive. If the country does not facilitate putting money at the end of the drill bit, they cannot have the success we are seeing in places like neighboring Ecuador. On the positive side, Peru has an established mining tradition and is well organized. Palamina has a team with 35 years of experience in the orogenic gold belt alone, in a country replete with senior mining companies producing a large quantity of metal, which I cannot buy or sell to in Ecuador. ■

Industry Explorations PERU MINING 2018

drilling campaigns. The team has set aside around C\$3 million for its Lourdes and Pacaska gold projects this year. "During the downturn, there was a lot of ground available and very few companies were picking up exploration opportunities", related Steve Zuker, CEO of Pucara Resources. "Today, we control more than 300 square km, mostly in central and southern Peru, in Ayacucho and Cusco. We are one of the few juniors doing grassroots exploration."

Pucara is focused on high-sulfidation, bulkminable gold projects, so it is open for joint ventures on its base metals projects. "We are seeing interest from mid-tier and major companies that are becoming more aggressive – this is new in the market. The BHPs and Rio Tintos are still in Peru but they definitely prefer projects that are more advanced," said Zuker. Another company with a similar focus on project generation, and that also plans its own drilling campaigns this year, is Condor Resources. Beyond its agreements with Chakana Copper and local mining companies, Condor wants to advance its Pucamayo, Andrea and Huiñac Punta projects. A year ago, Condor did a hybrid financing with Sandstorm involving both shares and royalties at Condor's early stage properties. "Pucamayo is our more advanced project, both from a technical and a permitting perspective," declared Ever Márquez, VP exploration at Condor. "It is an epithermal gold project and next to it we have identified a porphyry copper-gold area."

Finally, Miramont Resources, a company formed last year, has two main projects of focus: Cerro Hermoso, a gold, copper and poly-metallic breccia type prospect in Puno, where the company is permitting an initial 5,000-meter drill program; and Lukkacha, a porphyry copper project situated in Tacna, 55 km from Southern's Toquepala mine. Being a foreign company, for the latter project Miramont requires a special approval from the central government due to the fact that Lukkacha sits within 50 km of the Chilean border.

Bill Pincus, president and CEO of Miramont, gave his impressions about the current state of the exploration market: "In the last decade, a lot of larger companies overpaid for projects and the cycle went down, which in turn caused companies to become very conservative. The effects of this can still be seen; certainly in the copper space there is a dearth of good exploration and new development projects for the large producers."

Lγle Davis

President and CEO
CONDOR RESOURCES



Could we have a summary of Condor's latest corporate developments?

Condor is a project generator and an explorer, with a focus on precious and base metals exclusively in Peru. We have projects that are being actively worked by third parties, but we also plan to carry out our own drilling campaign this year at Pucamayo, and have started the permitting process for our Huiñac Punta and Andrea projects.

How is the market evolving in terms of access to financing?

A year ago, we did a hybrid financing with Sandstorm, whereby they became an important shareholder and also acquired small royalties in half a dozen of our early stage properties. This was important because, from a reputation point of view, having Sandstorm on board is like having the Good Housekeeping stamp of approval. Certainly, institutional investment is coming back, but the retail side has not picked up yet. In any case, today two thirds of the financing for junior exploration is coming from bigger, established mining companies, so the model seems to be that the majors are using the juniors as their exploration teams. At Condor, we have to raise our corporate profile to have better access to financing. The retail market does not recognize us as a project generator but the mining companies do, including both small and larger mining companies.

What is Condor's competitive edge?

We have a solid reputation in the mining community in Peru and Chakana is a great example of that: David Kelley was in charge of the exploration programs for MMG, and his first pick after forming Chakana was the Soledad project that Condor generated. Most of Condor's properties are not the obvious projects out there. We have a lot of experience exploring in this belt and that is our competitive advantage. We can identify opportunities where others do not, in areas that have never been drilled. Pucamayo and Ocros, for instance, were not easy opportunities to identify, yet they offer enormous potential. That is our expertise as a project generator.

64

6

Bill Pincus

President and CEO

MIRAMONT RESOURCES



How did you decide to put together Miramont Resources?

I have 40 years of experience as a geologist, consultant and executive in the minerals industry, and most of my career has been in the exploration and development phase. In 2002, I formed a junior company called Esperanza Resources which successfully discovered two deposits in Peru and Mexico before being acquired by Alamos Gold. Miramont was formed in June 2017, with a focus on two main projects, Cerro Hermoso and Lukkacha.

What type of mineralization is Miramont looking for in the Cerro Hermoso project?

Cerro Hermoso is located in the Puno region, 60 kilometers west of the city of Juliaca. A full geologic investigation has been completed and now we are preparing for an initial 5,000 meter drilling program to test various targets. Cerro Hermoso is a breccia-pipe prospect targeting gold, silver, copper, zinc and lead mineralization. The two principal commodities there would be gold and copper.

Can you tell us about the second project in Miramont's pipeline?

The Lukkacha project is a porphyry copper prospect situated in the Tacna region, located within 50 km of the Chilean border and 55 km southeast of the operating Toquepala mine of Southern Copper. Miramont has just completed a round of detailed mapping and geochemical sampling. Before we go any further, we intend to negotiate and finalize an agreement with the community and, more importantly, under Peruvian law a foreign company operating within this frontier zone requires a special approval, and we hope to complete this process by the end of the year.

Does Miramont have any particular institutional backers?

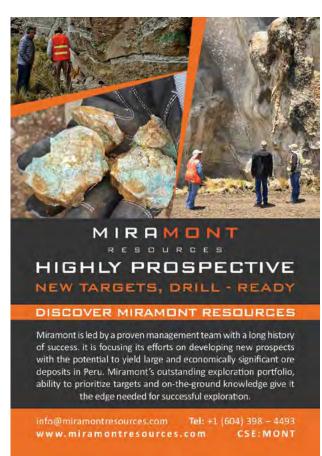
Right after we established the company, we raised C\$6 million. One of Miramont's largest shareholders is a fund from Amsterdam called Plethora Capital. The financing was co-sponsored by Sprott and Red Cloud KS. Miramont is currently listed on the Canadian stock exchange and the U.S. OTXQB exchange. We are still a micro-cap company. Eventually Miramont will migrate to the TSX-V.

How do you think the markets are behaving right now compared to other cycles?

I do not see a return to the boom and bust cycle, it seems that things are smoothing out and less volatile. In the last decade, a lot of larger companies overpaid for projects and the cycle went down, which in turn caused companies to become very conservative. The effects of this can still be seen, certainly in the copper space there is a dearth of good exploration and new development projects for the large producers. Therefore, I think if Miramont can have some early success, and we have already received a lot of attention, there will be a big demand. The known deposits are already being mined and in some cases running out of reserves, and I believe there will be a scramble for more gold projects as well. However, I am most optimistic about the copper space.

Have government efforts to simplify permitting streamlined the process?

We are applying for our drilling permits now. It is a very clear, transparent process – companies know what has to be done and the necessary steps that must be taken to get a permit. It will not become a fast process overnight. However, the new government has shown a real commitment to keep the process as straight forward as possible. The supreme decree Miramont has applied for is moving a lot quicker than anticipated.



Industry Explorations PERU MINING 2018

Uranium and Lithium

A new discovery puts Peru on the global lithium map

2017 was a transformational year for Plateau Uranium, now rebranded as Plateau Energy Metals. While exploring in one of its areas in the Macusani plateau, the company made the Falchani discovery, containing uranium but also high lithium grades of 3,500 parts per million (ppm). "The deposit is at least 100 meters thick and two square kilometers in area. We are quite confident that this will be among the top lithium resources in the world. It is a totally new style of rock: you can process it easily and it is within 200 meters of the surface, so it is open-pittable," declared Ted O'Connor, director of Plateau Energy Metals.

The Falchani discovery adds to the sizeable resource the company

had already defined in the area of 124 million pounds of uranium and 176,000 mt of equivalent lithium oxide. "As we move west towards the Falchani area, the focus is increasingly on the lithium," explained Laurence Stefan, president and COO of Plateau Energy Metals.

Now, the company needs to define the size of its lithium resource and confirm that the extraction will be straightforward and economic. Meanwhile, president Vizcarra announced government plans to pass new regulation needed to exploit uranium resources in the country, which would be a key milestone towards the development of Plateau's uranium and lithium resource.



66

Laurence Stefan & Ted O'Connor

LS: President and COO
TOC: Director
PLATEAU ENERGY METALS





2017 was quite an eventful year for Plateau Energy Metals. Could you give us more details on the Falchani lithiumuranium discovery?

TOC: In 2017, the community of Chacaconiza invited us to do work in their area. There, we found the best expression of uranium radioactivity at surface that we have seen anywhere in the plateau. We started drilling and we found uranium, but we also found these unusual rocks that we had never seen before, with very high grades of 3,500 ppm lithium. The deposit is at least 100 meters thick and two square kilometers in area. We are currently drilling there and we expect to have our resource this year. We are quite confident that this will be among the top lithium resources in the world. It is a totally new style of rock: you can process it easily, it is within 200 meters of surface, so it is openpittable - it is going to be big. It is a tremendous discovery for our company, but also for the future of lithium and uranium production in Peru.

How does this add to your existing resource in the other areas of the Macusani plateau?

LS: At present we have 124 million pounds of uranium in the ground, and 176,000 mt of equivalent lithium oxide. Now, as we move west towards the Falchani area, the focus is increasingly on the lithium, because the new resource is expected to be one of the largest lithium resources in the world. Having said this, the uranium at Falchani is double the grade of our uranium to the east, so we will end up as well with a significantly expanded uranium resource on surface.

Do you expect the lithium to be easily recoverable?

TOC: In most hard rock lithium projects, you essentially have to melt the rocks, cool them quickly and heat them with acid. Our rocks are exactly the same chemistry as a pegmatite, but they are volcanic rocks so they cooled extremely quickly. In this rock that has 3,500 ppm lithium, we get 80%

of the lithium out by using warm sulfuric acid. Our solutions have 2,500-2,700 ppm lithium in them, as opposed to 250 ppm in a normal brine.

LS: At Macusani, the beauty of our rock is that the quenching already took place naturally, probably at the time of the eruption, and now we just need to heat a cake to 80 degrees for 12 hours. Even if that may not be as cheap as extracting lithium from the brines, we will be very close to that, and we will certainly be much cheaper than other hard rock lithium deposits.

When do you think the uranium market will improve?

TOC: In a US\$22/lb spot market, not much production is being sold at that price because no-one can make any money. That is why Cameco and Kazakhstan have shut production. I do not think uranium will go back to prices of US\$130/lb, but it will certainly be north of US\$50/lb, because demand is predictable. At least 10 new reactors come online every year, and each of them needs an initial load of 1.5 million lbs, and additional 500,000 lb per year, on average. Our uranium project is too big to be ignored, and it breaks even at US\$23/lb, with cash costs of US\$17/lb in our uranium only.

What is your relationship with the communities in the Macusani plateau?

LS: We have intense programs with them. In the past we have been working with Isivilla, Tantamaco and Corani. Then we worked with another two communities when we drilled Pinocho. Moving west now with Falchani, we enter into areas with communities that have been far away from our core of action, like Chacaconiza and Quelcaya. The weather there is colder so there is no agricultural production. People mostly have livestock and the approach has to be different. We hired two quechuaspeaking professionals who have been doing an excellent job. Now we have a warm relationship with the communities, that goes beyond the mere discussion about the economic aspects of our relationship.

Industry Explorations

Fertilizers

Peru has very high quality phosphate rock, but global markets are not helping juniors

Despite the poor forecast for global phosphate prices, the Sechura basin has become a hotbed for juniors due to its strategic location next to the ocean, its mineral richness that includes highly reactive phosphate rock, and a very large mine already in operation, initially developed by Vale and recently acquired by Mosaic.

One of the juniors in the area is Crops Inc. (previously Focus Ventures) with the Bayovar 12 project. Earlier this year the company published its beneficiation tests that showed a minimum of 30% P2O5 content

in their rock. With these results, the company has been able to sign MOUs with two phosphate rock merchants based in Switzerland, defining specific export destinations for the traditional phosphate fertilizer industry.

The shorter-term view for Crops Inc., however, is different. Its president, Gordon Tainton, has been looking at different methods to add value to the Bayovar 12 product given the low global phosphate prices: "We believe we have a genuine opportunity to produce elemental phosphorus (P4). P4 is

We do not see any dramatic changes in phosphate fertilizer prices in 2018 and we do not expect to see a significant shift. Looking at the medium and long terms, there is less arable land and there is a growing population base with a changing diet as well. Those are the drivers that will necessitate better use of nutrients with crop science and fertilizers at the forefront to improve yields.



- Gordon Tainton, president, Crops Inc.



Stephen Keith

President and CEO

GROWMAX RESOURCES



Can you give us details of GrowMax Resources recent history?

GrowMax previously had a two-tier strategy with an oil and gas division in Argentina and its fertilizer project in Peru. Abdel Badwi was brought in as executive chairman to reconsider our strategy, change the management team and conduct studies on our Argentina and Peru operations. The decision was taken to sell our Argentinian assets for US\$60 million, which recapitalized the company.

What assessments were made of your Bayovar property?

The original proposal at Bayovar was to develop a potassium chloride out of a potash brine resource. Further studies concluded that the project was more suited to being a Sulphate of Potash (SOP) project. Moreover, we further discovered approximately 500 million tonnes of fairly high-

grade near-surface phosphate. With these two assets, we completed a resource estimate and an internal design and economic assessment of the brine, a resource study on the phosphates and a PEA for the phosphate deposit. We have concluded that the phosphate deposit is an unbelievable asset, with a great location, sitting on the coast next to Miski Mayo. However, global phosphate prices have not been in our favor. I believe this will be a critical project for global phosphates but it would not be prudent to build it at present.

What has been the corporate strategy for GrowMax?

We are seeking to create cash flow but we have to be realistic as to why we are trading below our cash position. We have decided to invest our capital in specialty fertilizer assets, especially in Latin America. Due to population increasing, arable

68

PERU MINING 2018 Industry Explorations

one of the main materials used to make the Roundup weed killer. We investigated the North American and European markets and found out that all P4 demand for North America, Eastern and Western Europe is covered by imports from China and North Vietnam," explained Tainton.

He suggested that a second added value for the product can be achieved by coating the phosphate rock with a special polymer, further enhancing the nutrient release.

Meanwhile, GrowMax Resources' asset, the Bayovar property, is also located in the same region in northern Peru. The company's initial proposal was to develop a potassium chloride operation out of potash brine. Further studies have concluded that the asset was more suited to become a sulphate of potash (SOP) project. Furthermore, the company discovered approximately 500 million mt of fairly high-grade near-surface phosphate. For this year, GrowMax is focused on generating

cash-flow and has decided to invest its time and resources in the development of specialty fertilizer assets in Latin America. Stephen Keith, president and CEO of GrowMax, sees huge potential in the region with Peru's agricultural exports looking to double by 2021. The SOP project, however, needs to improve its numbers: "The initial results of the EPC study were not as good as we were predicting; the after tax IRR was not so attractive. The capex was set at US\$20 million for a 5,000 mt/y SOP operation. We are now optimizing the project."

With respect to the phosphate deposit, Keith referred to it as an "unbelievable asset" with a great location on the coast, next to Mosaic's Miski Mayo operation. "However," Keith continued, "global phosphate prices have not been in our favor. I believe this will be a critical project for global phosphates but it would not be prudent to build it at present."

land decreasing, and one of the largest agricultural basins being in Brazil, I believe investing in specialty fertilizers in this region is the right way to build cash flow. Our most valuable asset is cash and. with Peru's agricultural exports looking to double by 2021, we believe there are many opportunities that will be generating cash flow within a year of investment.

How difficult is it to educate investors on the fertilizers industry?

The number of research analysts in this space has drastically decreased and the few that remain are mainly focused on the larger companies. As there have been very few juniors that have been able to create a project, the market has been very cautious towards us. If you look at the TSX, it is riddled with juniors with zero value. Furthermore, it is also very difficult for investors to understand the dynamics of

the fertilizers market. Although they are defined as mining projects, the market is agriculture and you need to know the different dynamics. If you are mining gold, you are mining a bank vault, but the fertilizer market is different.

Can you give a final message to our readers on GrowMax's coming year?

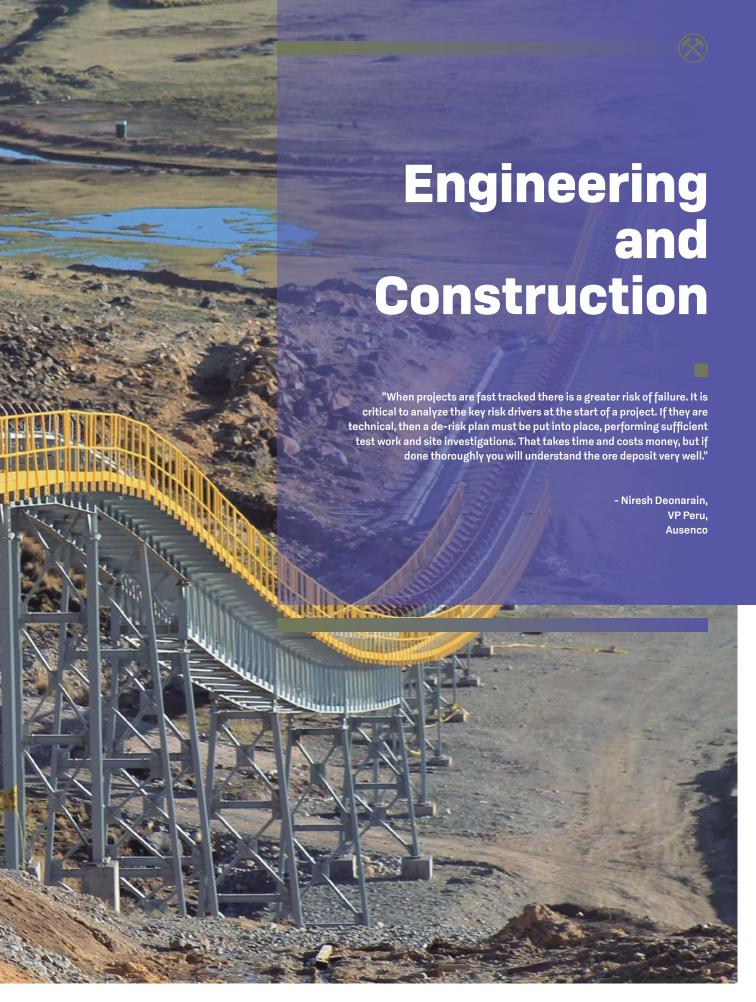
I am really positive about the coming year for GrowMax and I believe that the fertilizer space is a great one to be in. Although we have no control over the dynamics of the commodity, I believe that in the long term there is an upward trend. For Grow-Max, the logical step is to focus on the local Peruvian fertilizer market and see what we can be doing here, and then look at demand elsewhere. We will have to grow out of Peru as the project has a huge possibility to expand. Our focus is on creating a real project with near-term cash flow.





Stephen Keith President & CEO info@growmaxcorp.com +1-416-323-5782 www.growmaxcorp.com





Sharpening up Projects

An overview of the latest industry trends for the main consultancy houses

During the downcycle, engineering firms had to downsize and alter the approach that had brought much reward during the boom years. In order to survive, firms created synergies between different offices across the Americas, focused more on operations and environmental work, diversified into new sub-sectors and modified their rates to be competitive in the marketplace.

Now, however, the mining sector is back on a growth path, as noted by SRK Consulting's director Antonio Samaniego, who suggested that the new positive cycle should translate into higher levels of work across the board. Particularly in geology, he emphasized SRK's effort to develop its structural geology group with the support of SRK's offices in Canada and the U.K.: "All mineral deposits occur through the geological faults, and structural geology looks at finding the mineral enrichment zones. It is an interpretation of how the deposits were

formed. Before, this methodology was used for geotechnical work, but we are now applying it to exploration, especially in the narrow-vein mines we have in Peru," Samaniego said.

The return of the positive cycle does not mean that consultancy firms can relax their focus on tailoring their proposals for the sake of efficiency and cost reduction. In the words of Eduardo Ruiz, general manager of Amphos21, a firm specialized in the water cycle: "A hydrogeological study can cost US\$50,000 or US\$2 million; at the end of the day, you need to do a study that serves your client's purpose, and often consulting companies are not good at understanding that."

The Return Of EPCM Projects

Indeed, poor performance in engineering, procurement and construction management (EPCM) projects during the supercycle led to cost overruns and lengthy delays to reach commercial production. This, coupled with the sudden fall in commodity prices, prompted mining operators to look for cheaper alternatives to carry out their investment projects. In the words of Alexandra Almenara, general manager of SNC-Lavalin: "The downturn in mineral prices in the last few years has taught us lessons as we have had to struggle with less resources to deliver projects."

For a while, smaller EPCs became fashionable, but the savings of that model were often offset by the lack of integration between the different modules of the project, causing –again– delays, inefficiencies, and higher costs than originally budgeted. Denys Parra, general manager of Anddes, one

25

Reasons to celebrate

In 2018, SNC-Lavalin is celebrating 25 years of operations in Peru. During this time, together with our clients and partners, we have proudly contributed to the social and economic fabric of the country. ${\it iGracias Per\'ul!}$

STUDIES | MAJOR PROJECTS | SUSTAINING CAPITAL & CONSULTING SERVICES



● f in snclavalin.com/mining



Alexandra Almenara

General Manager
SNC-LAVALIN



Our ambitious objective is to become the most innovative digital company in our field. Our recent acquisition of Atkins, a firm globally known for their digital engineering innovation capabilities, reinforces this intention as a company.



Could you provide an update on SNC-Lavalin's position after 25 years in the country?

Over 25 years, SNC-Lavalin in Peru has completed a wide range of services from early phase engineering studies to the construction of important projects, such as the EPCM projects for Pierina and Lagunas Norte in the mining sector and the Fenix thermal power plant in the power sector. Our operation continues to provide quality engineering and construction services and intends to grow its presence in Peru, in the mining, oil and gas and power sectors. Our objective is not to pursue only big EPCM projects, but to develop long-term relationships with our key clients and support their needs in diverse range of projects and services from pit to port and from exploration to closure.

2018 is an excellent year for our company, not only for our 25th anniversary, but because the mining market is showing signs of reactivation and SNC-Lavalin is receiving a significantly higher number of requests for proposals than previous years.

Could you provide examples of mining projects SNC-Lavalin is involved with in Peru?

Studies remain our main area of business in the last years. We offer operational excellence and simulation experts involved throughout the project to stress-test the engineering, model and define the operational impact, including processes changes, digital technologies and automation.

Another value added is that SNC-Lavalin is used to successfully transition from engineering to construction and operations on many of our projects, making us experienced in understanding the requirements to minimize rework during construction. SNC-Lavalin has also developed an execution focus for brownfield projects as we understand the complex nature of operating plant projects. In addition to studies, we continue to support our clients supervising construction, such as the tailings dam regrowth for Antamina. This is an interesting example on how we can support our clients on a longer term.

With new mining projects announced, is SNC-Lavalin targeting big EPCM projects?

SNC-Lavalin is targeting EPCM and also EPC projects. Our local office is hiring additional local qualified resources for future prospects, but in addition, we also continue to be supported by our offices in Brazil, Chile, Canada and Australia. For copper we can bring resources from Chile, gold from Australia or Canada, and material handling usually from Brazil. As a company, SNC-Lavalin is promoting stronger collaboration among offices.

How can the industry avoid the mistakes of the past like large cost overruns and delays?

The downturn in mineral prices in the last few years has taught us lessons as we have had to struggle with less resources to deliver projects. SNC-Lavalin has learnt how to deliver good quality at more competitive costs. SNC-Lavalin has also learnt the importance of innovation to explore alternatives for improving efficiency and our CEO, Neil Bruce, has pointed out recently our ambitious objective is to become the most innovative digital company in our field. Our recent acquisition of Atkins, a firm globally known for their digital engineering innovation capabilities, reinforces this intention as a company.

Could you tell us more about the environmental and social services SNC-Lavalin provides?

SNC-Lavalin Peru provides environmental, social and permitting services in Peru since 2009. Our services include traditional requirements for baseline studies, monitoring, impact assessment and management plans, however our qualified team is also focused on offering alternative services for our clients to implement specific projects to reduce their impact on the environment and improve their relationships with local communities.

What initiatives have you worked on since the establishment of the Women in Mining Peru chapter?

Women in Mining (WiM) Peru's chapter main objective is to support the growth of female participation in the mining sector by providing training, mentoring and networking activities. The participation of women in mining is very low in Peru, with an estimate of a 6% participation. This figure is based on reports from a restricted group of mining companies but does not represent official statistics. Moreover, WiM Peru is also interested in understanding the roles and responsibilities that women have within the mining industry with the goal of generating opportunities for women to assume higher levels of responsibility.

TERVIEW Global Business Reports



Niresh Deonarain

Vice President Peru **AUSENCO**

Gold deposits are becoming lowergrade, more complex, and some are getting deeper. The technologies required come at a greater cost – bio-leaching, autoclave, and roasting, for example. Having said that, if you manage to reduce your cut-off grade, you can increase the ounces of metal produced and the

77

life of the mine.

Could you summarize the recent milestones in Peru for Ausenco?

Ausenco has close to 400 employees in Lima, and 70% of our workforce works at our Minerals and Metals division. In 2008, Ausenco purchased three companies – Sandwell, Vector and PSI. PSI specialized in large concentrate, slurry and water pipelines. We designed the Antamina concentrate pipeline as PSI, and continue doing work with Antamina as Ausenco. Sandwell was our entry into ports and terminals. The Sandwell team reside in Vancouver and Brazil, with the intention to expand into Peru. Vector was the third company, which looks at geotechnical, civil engineering, tailings, environmental aspects and certified quality audits (CQAs).

When Ausenco purchased these companies they brought in the minerals and metals skill sets. We now offer a complete solution, providing everything from the mine all the way to the ports, including infrastructure, pipelines, tailings, water and EIAs. Rather than just doing the process plant design, we have taken a holistic view of a fully integrated project. Ausenco has also started working with juniors in Peru. We are currently working on PEAs and front-end scoping studies.

How important is Peru for Ausenco?

Peru is Ausenco's second largest office globally. We have a great success story in the Constancia EPCM project, which remains as our flagship project globally. With the Mina Justa contract we will be adding to that, and there is a list of other similar projects in the pipeline such as Zafranal, which is very similar in style to Constancia.

Ausenco has taken a view that it is important to develop talent in-country. We are proud of our record of retaining a lot of the staff that worked on Constancia and other notable projects. We aim to bring in at least between six and ten graduate engineers per year. In addition to this, we bring in experienced, knowledgeable expat professionals to work in collaboration with our local employees.

What challenges does the complex metallurgy in Peru present?

In Peru there are some of the most unique polymetallic deposits in the world – copper, lead, zinc, gold, silver. You can find small mines with a capacity of 500 to 1,000 mt/d that require complex separation processes. To make mining in Peru work you need to understand the ore body. Some knowledge from other countries is transferable, but most is not. For example, copper deposits in Chile do not equate to copper deposits in Peru. The mineralogy and focus on geo-metallurgy is totally different. At the end of the day, having a deep understanding of the mineralogy determines the success of a project, especially when you are delivering flow sheets or a processing route.

How important is it to find a balance between performing studies thoroughly and not delaying a project?

When projects are fast tracked there is a greater risk of failure. It is critical to analyze the key risk drivers at the start of a project. If they are technical, then a de-risk plan must be put into place. The only way to understand if there are technical risks is to perform sufficient test work and site investigations. That takes time and costs money, but if done thoroughly you will understand the ore deposit very well. At Ausenco we believe that our plants have to be designed with meticulous detail and with a deep understanding of ore characterization, mineralogy and metallurgy. Those factors will drive tonnage and recovery.

How do you see the gold market moving with the transaction from oxides to more expensive refractory ore projects?

The deposits are becoming lower-grade, more complex, and some of them are getting deeper. The types of technologies that are required are not conventional and come at a greater cost – bio-leaching, autoclave, and roasting, for example. Having said that, if you manage to reduce your cut-off grade, you can increase the ounces of metal produced and the life of the mine. Fruta Del Norte, a key project Ausenco is working on in Ecuador, is a good example of this. It is a refractory project with elements that are not easy to recover. De-risking that project took a lot of focus to connect mining geology with processing, and model that through the whole circuit.

/:

Denγs Parra

General Manager

ANDDES



How is Anddes evolving in the Peruvian market?

We have been strengthening our division of electromechanical projects, which has been doing well. We can do the design of concentrator plants, crushers, mills and other plant infrastructure, covering anything related to process, mechanics, electricity and instrumentation. Our first project in this area was the feasibility for the expansion of the Las Bambas concentrator from 140,000 to 210,000 mt/d.

Beyond that, we were mostly known for what the EPCM companies call 'geotechnical work', which includes not only geotechnical engineering but also hydraulic, hydrology, civil and environmental areas. We have a very strong name in leach pads, but today we are promoting our expertise in tailings management and disposal. Last year, we organized the first workshop of tailings dam safety review presented by experts from the Canadian Dam Association in Peru and we are repeating this experience in 2018, with a stronger focus on mining dams.

How is the industry dealing with the tailings challenge?

Peru has increased its copper production significantly and that goes hand in hand with the increasing generation of tailings. The challenge is very big, for all parties involved. A tailings dam failure is always terrible news, no matter if it is a small leak. This year we have seen a small failure in Ancash were a tailings dam leaked 50,000 cubic meters into the nearby valley. The environmental impact of this may be small, but the impact on the mining industry's reputation is very important. Earlier this year, there was a dam failure in Australia, a country meant to have the highest standards, and in Canada we saw a dam failure in 2014. This is not acceptable and, as an industry, we need to raise the bar. In Peru, the design of any mining facility presents significant challenges due to the difficult topography, the seismic activity, the high levels of rain, the high altitude and other factors. Therefore, we need to design all the infrastructure in a solid and stable way.

Can you mention some of Anddes' recent projects?

We did the expansion of Pucamarca for Minsur, including the engineering of the enlarged leach pad and waste dump, the construction management and the quality assurance. We have also worked in the expansion of the tailings dam for Raura. In Cerro Verde we are doing a large engineering project and two studies for leach pad stability. From the Lima office we have also done projects in Ecuador, Brazil, Bolivia and Mexico. We are now starting an

important project in Mexico with Metallōrum at Lluvia de Oro, which is probably going to be a good opportunity to open an office in that country before the end of the year.

Do you see the engineering market heating up?

We currently have 250 people, 30 more than last year. We already see the market heating up, but we are taking initiatives to take care of our people. We have a very horizontal structure and all managers have an open doors policy. We offer competitive salaries and overall, we want to ensure that Anddes is a good place to work.





Image courtesy of Nexa

<< 72

of the largest Peruvian engineering firms with a team of 250 people, sees future projects returning to the traditional EPCM approach: "In general, I see the EPCM model coming back. However, low cost will continue to be an obligation moving forward. The only way this will change is if there is a multiplicity of projects that would generate a shortage of engineering capacity."

With this in mind, the traditional EPCM players keep their eyes open for potential opportunities as Peru unlocks its investment pipeline over the next couple of years. SNC-Lavalin, a company

celebrating its 25th anniversary in the country, expects to grab an EPCM opportunity following a few years where they had to gear more towards environmental, social studies and permitting work. Alexandra Almenara said: "Depending on the specific requirements for the project, we try to find the right experts in SNC-Lavalin from around the world. For copper we can bring resources from Chile, for gold from Australia or Canada, and for material handling usually from Brazil."

Australian company Ausenco, that handled the EPCM at Hudbay's Constancia and is in charge of the upcoming Mina Justa project, is now one of the strongest international engineering players in Lima, with around 400 people. Niresh Deonarain, VP Peru at Ausenco, summarized some of the main factors to be considered for successful project execution: "The only way to understand if there are technical risks is to perform sufficient test work and site investigations. That takes time and costs money, but if done thoroughly you will understand the ore deposit very well."

Cradle to cradle



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Synergy and M&A

Working in synergy became a key concept in the downturn as companies and offices brought together their diverse range of expertise in a bid to not only survive, but grow. Companies merged, and regional offices began to collaborate more. Hatch not only pushed for synergy between its Chile and Peru offices, but also acquired Indisa in Colombia. Following a merger, MWH expanded its range of action, now under the Stantec brand. Meanwhile, WSP entered the South American market aggressively with three acquisitions: Schlumberger Water Services, Poch (Chile) and ConCol (Colombia). Also, last year SNC-Lavalin completed the acquisition of Atkins, an 18,000-people strong consultancy firm.

On a smaller scale, SRK Consulting is now using the team from the former Mine Ventilation Services (MVS), a company it acquired in California, to carry out all the work related to ventilation in Peru's underground mines. "We are bringing a lot of expertise from this company," said Antonio Samaniego of SRK. "In Peru, you have some small ventilation companies, but through MVS we have exposure to much deeper mines from Canada and South Africa."

77

Antonio Samaniego

Director
SRK CONSULTING



What are the drivers for SRK in Peru?

The main driver for us is the geological aspect. We are currently developing our expertise in structural geology. All mineral deposits occur through the geological faults, and structural geology looks at finding the mineral enrichment zones. It is an interpretation of how the deposits were formed. Before, this methodology was used for geotechnical work, but we are now applying it to exploration, especially in the narrow-vein mines we have in Peru. Also, the Peru office is working very strongly on due diligence processes and 43-101 reports. As an example, the 43-101 report for Nexa's New York IPO was prepared in Peru.

What developments do you see in underground mining?

SRK acquired Mine Ventilation Services, a company from California that we are using now to do all our work related to ventilation locally. Underground mining is shifting towards battery-powered equipment, although from an economic standpoint, the technology still does not justify the paradigm shift from diesel to battery-powered machines. While we will have less fumes in the mine, we will

still require fresh air to cool the equipment down. At the end of the day, the ventilation engineers will not disappear, the technology will just have to adapt.

Do you have an environmental practice?

SVS Ingenieros, the company we formed in 1985 and that merged with SRK in 2011, has a legacy expertise in geology, geotechnical and environmental. Today, we still have a strong environmental team and, within that, we have created a dedicated division for mine closure plans. Through the mine closure plan of Pierina, we are acquiring significant expertise for future projects. Mine closure plans are very comprehensive and in open pit mines you may have to do monitoring for around 30 years after the mine closes.

In which areas have you seen more innovation lately?

Innovation is resulting in software that is increasingly flexible and easy to handle all the mine design. Also, you have a lot of innovation on the metallurgical front, with solutions to process arsenical copper or arsenopyrite-encapsulated gold, to extract minerals in a more economic matter.

Paul Murphγ

Manager South America
MINING PLUS



Within your range of services, where do you see the biggest demand?

The biggest demand is coming from underground mining, and where we find that companies effectively single source our services is in bulk underground mining (sub level and block caving). There is very limited experience for these methods here in Peru, which offer high production rates and low operating costs. They will become more common in the country considering some pits are coming to the end of their reserves and there is a push to go underground whilst maintaining high production rates to utilize the existing infrastructure.

With the improved metal prices, are companies rushing to drill?

The mining cycle is driven by fear and greed. Companies have been fearful and conservative for the past three or four years, and now the sentiment is changing very quickly to one where they are fearful, but in a completely different way. Fearful that if they do not act immediately they will miss out on this coming cycle of higher commodity prices. So there is a rush on to get targets drilled and get the required studies fast tracked to move projects towards production as soon as possible.

What are some of the biggest mistakes you see with study work for mining projects?

One aspect of the study process that could be done better is that many companies artificially constrain themselves when putting in for environmental approvals. This way, they are locked into a sub optimal plan from the beginning, which makes it more difficult to realize the maximum project value.

Sometimes it seems the philosophy is to do a quick "feasibility study" for the purposes of an EIA, and then come back and "optimize" the study at a later date. I completely understand the drivers to do this as the EIA process is a long one, but I would encourage companies to do a reasonable amount of study work to ensure the mine plan within the EIA is as close to "optimal" as possible, and at a minimum, consider putting in an EIA that is at the upper end of the scale of what the operation could look like. This at least offers some flexibility to optimize the project within the larger scale mine plan. \blacksquare

Pierre Montauban

Peru Country Manager **HATCH**



What have been the main developments at Hatch in South America?

We have continued with our three main business lines, Metals (mining), Infrastructure and Energy, and have created two more, called Digital and Investments - our focus for Digital is to help access the right data and improve productivity. We entered Colombia through the acquisition of Indisa, adding seasoned engineers with very competitive rates. In Chile, we have had a major expansion with a 25% increase in staff, from 400 to 500 people. We have real synergy between our Chile, Peru and Colombian offices. In Peru, our emphasis is in operations and we are currently working with Las Bambas and Minsur on this aspect. We have also conducted a pre-feasibility study on a small expansion for Antapaccay. We are not concentrating on construction, although we do have the expertise elsewhere, especially in Chile. Right now mining represents 95% of our business in Peru.

Can you give us examples of your operational readiness projects in Peru?

Out team has been involved in large projects like Las Bambas, where together with the client we developed a "model for an accelerated ramp up;" Antapaccay, where we helped the client significantly reduce the planned ramp up time; and Antamina's expansion project, where we supported the operational readiness, commissioning, handover and ramp-up process. Our Operational Readiness team in South America is indeed very well-known across Hatch globally for their work in this area.

In which particular sector of the valuechain is Hatch's engineering expertise?

When we focus on engineering, our work is in the early phase between conceptual, pre-feasibility and feasibility stages. After this point, it is difficult to compete with local players. At an early stage, we can leverage our expertise and knowledge and this is where the real thinking is done. In our view, clients should look at value rather than money. The cost of engineering is little compared to the cost of the whole project and the difference good engineering can make is vast. If a company does not choose wisely, it will cost them millions of dollars in the long run. ■

Federico Schwalb

General Manager **BISA**



What is BISA's position in Peru's engineering and consultancy market?

2017 was clearly more focused on engineering and construction management for BISA. The rest of the work came from technical studies in mining and geology. We no longer have a division dedicated to environmental work, however we incorporate the environmental aspects in our studies. By industries, mining represented 82% of the business. We currently have a team of 200 people.

How is capex-related work gaining ground as opposed to business improvements?

We have consolidated our optimization team and we are doing work in areas such as energy optimization, mine drainage and ventilation. Having said that, this year we expect work to be more geared towards capex, even if it will still be based on studies for the vast majority. We have a global agreement with Gold Fields for small projects, and we are working with other companies like Chinalco, Cerro Verde, Antamina and Yanacocha. Other clients include Volcan, Buenaventura, Kolpa and Nexa Resources. Generally speaking, there is clearly more

work in mining than last year. In 2017, we prepared more than 200 mining proposals for a total value of US\$51 million. Of that, we were awarded a bit more than US\$10 million. This year, just between January and February, we presented 80 proposals worth US\$15 million.

How can mines increasingly collaborate with neighboring companies if needed?

There are many opportunities for collaboration. For Gold Fields and one of its neighbors, we did a study to develop these deposits using the optimal formula, and we evaluated 40 different tailings locations. Another example of cooperation is in the area of Michiquillay, Conga and Galeno. We simulated a joint operation with a single processing plant and tailings dam. This could provide huge savings, as well as very important environmental, social and reputational advantages. Also, in Peru's central belt, you have hundreds of mining companies working side by side, and you could integrate these mines today, some companies have different mines that are run completely independently. In the past, we already helped Milpo integrate their Porvenir and Atacocha operations.

PERU MINING 2018 Industry Explorations

Water and the Environment

The trend towards more sustainable operations cannot be reversed

Between January 1st and August 1st 2018, the human race used a year's worth of the planet's resources, according to the Global Footprint Network. This year's so-called 'Earth Overshoot Day' is the earliest ever. In other words, says the organization, we are using 1.7 Earths per year at the current rhythm of consumption.

If we analyze this from a mining perspective, it is easy to see why the industry needs to push harder to mitigate its impacts. In this context, water has been a constant topic of conversation in Peru due to its scarcity in certain mining areas and the country's climate variations. Moreover, there are now greater demands from the different stakeholders to improve water management. As an example of this trend, the Mina Justa copper mine by Minsur, currently under construction, will only use sea water for the operation.

Andrés Fernández, until recently general manager of WSP in Peru, has seen a changing attitude in the market in regard to water: "There is now an increased awareness of the importance of water, not only in mining operations but also in the surrounding communities and the regional governments. Peru now has a new detailed accounting system, called the Water Balance, which calculates how much water mines receive, how much they use, how they use it, and how much is recirculated and recycled."

Charles Vuillier, principal engineer at ATC Williams, an Australian firm specialized in tailings and water management, provided more insights about the water balance: "A deficit of water can be problematic in an arid country, and the cost can be difficult to control; it can range from US\$2

to US\$5 per cubic meter of water. If there is an excess of water, then there is a safety issue, such as water going over the tailings storage facility or seeping into the ground, therefore polluting the aquifer."

Water is often looked at for its socio-environmental implications but, beyond these key components, water sourcing costs can actually make projects uneconomic. According to Eduardo Ruiz, general manager of Amphos21, the first thing companies should understand is the way the whole water cycle works in the operation: "Often, you see companies that treat the effluent water after the operation and then dispose of it, while at the same time they pay their water rights to extract fresh water. In those cases, it would be easier, and certainly cheaper, to recirculate the water in the operation instead," he said.

With regard to tailings management, one of the main challenges is the large volumes that need to be handled. New environmentally-friendly technologies to enhance safety and improve water recovery are yet to prove an economic case for the larger operators. According to Gustavo Bravo, Latin America mine waste division leader at Golder: "In the future, filtered tailings will be the solution for the issue of mining waste in larger operations, but globally there is still not a great deal of experience in processing and filtering large volumes. I think there will be a natural process of maturity for the technology to reach the point in which it is a more viable solution."

On top of environmental and economic considerations, the social aspects are also fundamental, said Gerardo Leunda, partner at ERM, an environmental consultancy: "We are aware that, in projects

like Michiquillay and Quellaveco there are certain stakeholders that are not favorable to these investments. The calendars of mining companies do not coincide with the timelines of the communities, so that needs to be harmonized. The biggest challenge, more than the technical aspects, is to be able to establish good relationships with the different stakeholders early on."



In mine tailings, we test the penetration resistance, hydraulic conditions, and elastic properties of the material. This information can be used for understanding liquefaction potential, slope stability, material inventory, consolidation, and more. Recently we imported a barge to Peru and completed a project over water in the tailings facility for an important mining operator. Previously, they could not have done this investigation as there was not suitable equipment in the country.



- David Slack, vice president, ConeTec Group



What would you say are the main trends in the treatment of mine waste?

Filtered tailings have been a good solution for smaller or medium sized operations. For the large copper mines, the adoption of this technology is a matter of the energy cost and the substantial cost of finding extra land on which to install these facilities. I believe that in the future, filtered tailings will be the way to go to help solve the issue of mining waste in larger operations, but industry-wide there is still not a great deal of experience in processing and filtering large volumes. I think that, as far as the technology goes, it is a natural process to evolve to the point in which it is a more adequate and viable solution for large volumes.

What are the solutions to make the most of space limitations and improve the footprint of the mines?

It is a matter of bringing in new technologies and performing the necessary trade-off studies. Solutions such as using an old pit facility to receive tailings or waste, and using dry stacking, filtering and a mixture of conveying and trucking are all being implemented. The footprint of the operation is critical. As consultants, one of the first discussions we have with our clients is what the potential footprint could be, as well as what is the possibility to expand land rights outside the current boundaries. Social and environmental considerations are fundamental to the mining industry. Whenever a new technical solution is being considered, it has to be evaluated hand in hand with socio-economic and environmental aspects. From that perspective, Golder brings a broader perspective to the problem.

Moving forward, where does Golder see the biggest demand coming from over the next couple of years?

Golder is already seeing the trend of existing operations trying to develop more brownfields rather than greenfield projects. Companies want to take care of their available capex and try to expand current operations by developing new facilities within their property, investing in new technologies, using recycled water as much as possible, reducing the waste, and maximizing the minerals they can extract from waste.

Dan Etheredge

Regional Manager South America **KLOHN CRIPPEN BERGER**



Can you outline the range of services that Klohn Crippen Berger (KCB) offers?

KCB is a niche consultancy, mostly known for tailings dam design. As an example, KCB was called in to do the diagnostics after the Mount Polley and Samarco dam failures. Now we have a few general service agreements with some of the large multinational mining companies, and we do high-end dam safety reviews and risk assessments for all of their mines worldwide.

Apart from tailings dams, KCB does water dams, foundation studies, slope stability, rock mechanics – anything related to mine waste. We do a lot of environmental EIAs, baseline studies, geochemistry, modelling, water quality predictions and forecasting. For the tailings portion, KCB specializes in site selection and deposition modelling, delivery and return, piping and pumping.

Are companies increasingly limited with their footprint to manage their tailings?

It depends on the mine's location, boundaries and topography. For example, KCB did the site selection for Antamina for their current tailings facility over 10 years ago, and we also did the one that is being designed now. On a site with steep valleys, it is necessary to have

a large dam, but it will provide small storage, and the risk can be high. Many factors need to be taken into account – the ratio of storage volume to the height of the dam; distance to the mill; how far you have to pump the water; and potential social factors. KCB helps its clients perform options analysis to make a decision on the best course of action.

How do you see technology for tailings dams changing?

The introduction of new technologies has been a key focus since the Mount Polley and Samarco failures. We are currently doing an 18-month long study in Brazil for Vale on different filtered tailings scenarios. KCB set up a pilot plant, and is using the Vale tailings streams to do geotechnical characterization of the different structures that we are building. After Samarco, Vale decided that they wanted dry stack tailings in all their facilities. This is a challenge logistically: in an area with high rainfall and in a super high production mine, you would need to have at least 100 filter presses in line. KCB designed and built a dry stack facility in a super high rainfall area in Alaska, so it can be done, but the volumes in a large mine in Peru or Brazil are much higher.

PERU MINING 2018

81

Eduardo Ruiz

General Manager

AMPHOS21



How did Amphos21 open up an office in Peru?

Amphos 21 began its activities in 1994 within the framework of the nuclear waste management industry. Our water expertise started from there with the need to improve the knowledge of the migration of pollutants in rocky environments. All the hydrology knowledge was transferred to other areas, such as mine water management. In South America, we have consolidated our presence with two offices, in Santiago and Lima, from which we have also done smaller projects in Colombia, Argentina, Dominican Republic or Panama. We have a team of more than 100 people in the region, 60 of which are in Peru.

How could the mining industry improve water usage?

One of the key aspects is to have an integrated view of the water cycle of the operation. Water resources are increasingly scarce, so you need to look at opportunities to be more efficient: how you can use less water, how you can reuse more water, how you can stop polluting water. There are many inefficiencies across the industry. Often, you see companies that treat the effluent water after the operation and then dispose of it, while at the same time they pay their water rights to extract fresh water. In those cases, it would be easier, and certainly cheaper, to recirculate the water in the operation instead.

What has been your commercial strategy in Peru so far?

Our studies are highly tailored to the needs of the clients. A hydrogeological study can cost US\$50,000 or US\$2 million; at the end of the day, you need to do a study that serves your client's purpose and often, consulting companies are not good at understanding that. In this respect, we have been very well received by an important range of the major mining companies operating in Peru, such as Buenaventura, Minsur, Glencore, Hudbay and Antamina. We also work with large engineering firms, and we have had a strategic alliance with Anddes for some time now.

Is your revenue mostly driven by capex or opex projects?

In Peru Amphos 21 was born and has been expanding during this last crisis, and we have had double-digit growth every year. So far, growth has been driven by the operational side, as mining companies look at being more efficient with their water management. Probably now, with a better market condition, we will start seeing more revenue coming from greenfields, but we still have a lot of space to grow in existing mining operations that are not our clients. For us, this is also a good moment to look at expanding to other countries in Latin America, like Ecuador and Mexico.

What innovative approaches can we expect in water management?

The region encompassing Peru's south and Chile's north is very arid. In Chile, we have seen several mines using desalination. It is a great alternative, but it is costly. In that country, we have also seen a very interesting new solution, which is to capture and condensate water from fog.

At Amphos 21, we have a strong innovation arm, with ties with universities and research entities. A big focus for us right now is mine closure: we are doing an interesting research project in this field, in parallel with projects for clients, because the region has not had many closures and there is not a lot of experience out there.



"Policies and standards have not changed that much since the Samarco disaster, however companies are much more vigilant to monitor these standards and ensure that there are no mistakes. An interesting development in the market right now is that there are several operations approaching mine closure. These closures are normally rather expensive so it is in the operators' best interest to implement these programs during the up-cycle as there is more money to do so."



- Alberto Coya, Peru country manager, Stantec

"The cycle of commodity prices is moving in the right direction and we already see the industry being more dynamic. This is when companies want to produce more, decrease costs and implement different improvement opportunities — our Advisory unit in Hatch is perfectly suited for this. Our aim is to double our advisory team this year, with a 30-40% growth on a yearly basis to 2020."



- Alfredo Remγ, regional director Advisorγ and Business Improvement, Hatch

"Going for functional designs is essential to optimize the capex. Our role as designers is to help clients visualize the projects better at the front end, because that is where you define the cost. If you do big industrial complexes with large steel structures, you create a monster that is going to cost a lot of money. We must avoid this and visualize the right and complete solution in advance, within the expected time and budget, and complying with all the social and legal permits."



- Víctor Anyosa, general manager, EPCM Experts

"From a revenue point of view, what drives our business is the construction segment. However, our strategic business is our metallurgical consulting and the engineering, because they open the door to many projects. With many clients, we started with the metallurgical tests, and we were then involved in the construction of the production plants. In Peru, we have already expanded from gold and silver, where we are the leading player, to poly-metallic operations, including very large copper mines."



Manuel Ortega, general manager,
 HLC Ingeniería y Construcción



"In 2017, we thought it was the right time to renew our corporate image, representing who we are as a company. The new color palette, incorporating hues of green and gold, captures the notion of growth, resiliency and new energy. A dark shade of green at the center of our logo signifies our history. Our logo focuses on the notion that we thrive on challenges. As problem solvers, our engineers and scientists love to "unpack" complex issues and develop practical and effective solutions."

- María Eugenia Parot, principal and VP Latin America, Golder



"At the end of 2017, we patented a technological process called directional drilling for pit dewatering. This process has reduced the amount of drilling needed as well as the number of pumping stations required. It also increases safety as one is able to walk outside of the pit perimeters. By maintaining a drier pit, you reduce the number of explosives needed, you increase efficiency and you reduce maintenance costs."

- Andrés Fernández, former Peru country manager, WSP



"Unlike other players, we do not have an engineering division, and that is why we have not suffered as much with the lack of new investment projects. What is clear is that, with the low cycle, mining companies have changed their strategy in regards to the way they handle their profits. Probably they are more focused on giving dividends to shareholders than to investing in greenfield ventures, and this is why most mining houses have been dedicating their efforts to expanding existing projects."

- Gerardo Leunda, partner, ERM



"By using sensors, we can monitor remotely every aspect of a tailing such as particle size distribution, rainfall and seepage. We are also working with Dassault Systèmes on a system to digitalize all the information on the tailings from the back of the process plant through to the storage area. This will allow mining companies to see online all tailings dams around the world, and calculate how much time they have left to build extra storage. This is the future of mining."

- Charles Pol Vuillier, principal engineer, ATC Williams

Contractors-in-Waiting

The execution of Quellaveco and Mina Justa should increase levels of work

Similarly to what happened in the engineering spectrum, a number of contractors diversified their portfolio of services during the crisis, whilst also focusing on increasing opex projects to provide a steady cash flow.

OHL, which arrived in the mining sector in 2012, has expanded its range of action. "In the past, the market probably saw OHL as a company focused on earthmoving, but we can do much more than that. For example, we are currently executing three tailings dams' contracts, none of which are for earthmoving," said Martín Fernández, mining manager Latin America at OHL.

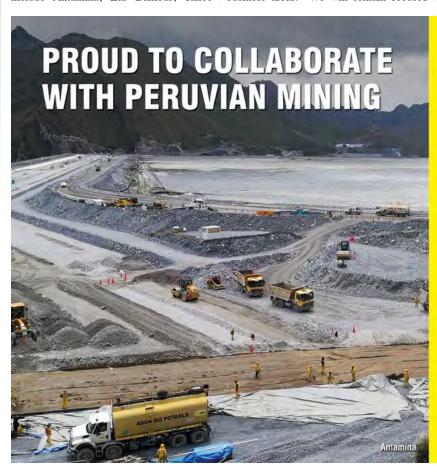
The company's mining clients in Peru include Antamina, Las Bambas, Tahoe

Resources and Anglo American. Ricardo Vega, president of OHL in Peru, highlighted that mining generated 77% of OHL's construction revenue in the country last year. As an example of OHL's capabilities in value-added services, the company recently completed an EPC project for the crushing, agglomeration and transportation facility for Tahoe Resources' Shahuindo project in Cajamarca.

STRACON, until recently part of the Graña y Montero Group, has started a new phase under new shareholders, namely Ashmore Group and Steve Dixon, the company's CEO. Dixon affirmed that the recent transaction will allow STRACON to enter new business areas: "We will remain focused

on our core business, which is contract mining and bulk earthworks in Latin America. However, we now have an opportunity to broaden our service offering and implement further geographical diversification."

As an example of STRACON's capabilities, Dixon spoke of their work at Cobre Panama, where the company provides a number of services outside its core activities, while in Peru, STRACON handles the contract mining operation at Tahoe's mines and is also doing construction for the tailings facility at Constancia. STRACON has a goal to replicate the US\$460 million it had in sales in 2014 by 2020, and for that it is open to sign joint ventures and acquire new companies in the region as well.



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Ricardo Vega & Martín Fernández

RV: President Peru MF: Mining Manager LATAM OHL





How does the creation of a regional manager position for mining fit OHL's strategy moving forward?

MF: In 2017, OHL identified great potential in certain mining clients that offered a stable and sustainable business, and hence we decided to create a transversal regional management position. Both mining companies and EPCM players whom we target as potential clients are global companies and we have always remained humble in order to develop strategic partnerships in the mining sector. Our initial contract with Las Bambas, for instance, was for US\$1.5 million, but over time, it has grown to US\$250 million.

Are you currently increasing cross-selling of your different areas of expertise in mining projects?

RV: There are many synergies between our construction and industrial businesses, especially in mining. Last year, mining generated 77% of OHL's construction revenue in Peru. We are not only growing in the mining operations where we are already present, but we are also obtaining contracts with new clients. For a company that only entered the mining sector in 2012, we have done very well. In the industrial side of things, we have recently completed an EPC project for the crushing, agglomeration and transportation plant for Tahoe Resources at Shahuindo, in Cajamarca. This is a state of the art plant. Thanks to OHL's procurement capabilities, we can adapt very well the crushing systems, the conveyor belts and the grasshoppers, to the needs of the client. It is a tailor-made solution.

MF: We can take care of any aspects within the EPC segment. In the past, the market has probably seen OHL as a company focused on earthmoving, but we can do much more than that. As an example, we are currently executing three tailings dams contracts, and none of them are for earthmoving. Also, on the industrial side of things, the EPC for Shahuindo has been a great success, because OHL offers great flexibility, having our own brands for equipment, installation and maintenance.

Furthermore, we have just installed the first anti-thunderstorm structure in a mine in Peru, at Antamina. It consists of a very

large marquee of 1.3 km and 30 meters in width. We have done the engineering together with a partner, and it is a good example of our engineering capability when focused on production and safety. For 2018, one of our big objectives is to enter the underground mining business. We have very strong expertise in tunneling for civil works, but we have never applied that expertise to an underground mining operation.

As a large contractor employing many people, what is your approach to safety?

MF: The first aspect in safety is the company culture, but this culture needs to be implemented. At Quellaveco, we are investing 48,000 hours per month in training. This is more than 4% of the total man-hours at this project. We understand that without intensive training, a job cannot be safely completed. Moreover, due to the way mining clients operate, all the responsibility for safety falls on the managers' shoulders. Managers need to be true leaders and make sure that the culture permeates all the way down.

What are your expectations for 2018?

MF: This is expected to be a very good year in the mining sector. The first weeks of 2018 were very positive, with an enormous amount of tenders and requests for quotations. Earlier this year, we obtained our first contract in Colombia as well, with the Cerrejón coal operation, which is a key milestone. In Peru, we continue working at Quellaveco, Shahuindo, Antamina and Las Bambas. Meanwhile, in Chile, we have one of the largest tailings dam expansion projects at the Talabre dam that serves Chuquicamata and other mines.

RV: We are a bit worried about the development of government projects, because 2018 was forecast to be a very good year in terms of public infrastructure, but it is not being the case. The mining sector is more stable and is less affected by the political swings. The fact that there is political uncertainty, however, does not change the fact that Peru is a 'home market' for OHL. We are strongly committed to the country and we are not going to stop any investments here.

Industry Explorations



Steve Dixon

CEO STRACON

We have an aggressive target of reaching US\$460 million in sales by 2020, but that will require geographical and service diversification. One of the great things about having Ashmore as a shareholder is their financial strength and capacity to invest in the growth of our business.

77

STRACON has initiated a new phase under new shareholders. Could you walk us through the history of the company?

STRACON started in Peru in 2003, when we assumed a joint venture position with Graña y Montero (GyM) at El Brocal, where we initially had a project management role. Then, over a period of time, we put together an agreement with GyM to undertake other projects together, including Shougang, La Zanja and La Arena, before consolidating these activities into a new company, STRACON GyM S.A. at the end of 2011. Since then, we operated as one company, with branches in other countries including Colombia, Panama and Mexico. In 2017, as part of GyM's divestment program, they decided that STRACON was one of assets they wanted to sell. As a result, in April 2018, we closed a transaction to leave the GyM group. The company continues its activities, with the same leadership team, contracts, equipment fleet and safety culture, but now has different shareholders, with Ashmore Group and myself.

Will the strategy of the company change under the new owners?

We will remain focused on our core business, which is contract mining and bulk earthworks in Latin America. However, with this transaction, we have an opportunity to reevaluate our strategy. We will broaden our service offering and implement further geographical diversification. We will not do that in a shotgun approach, though; it will be a planned diversification strategy over a period of time, initially in mining, and potentially also in infrastructure. At the Cobre Panama project, for instance, we already provide a number of services outside of our core activities, including the construction of the transmission line, a tunnel and mechanical and piping installation.

Who are your main mining clients right now?

We continue working in the construction of Cobre Panama, where we have nearly 3,000 people. We do the contract mining for Red Eagle in Colombia and, in Peru, we are currently at La Zanja and we have Tahoe's two projects, Shahuindo and La Arena. We also continue to undertake construction work at Constancia for the tailings management facility and other site works. Besides, we have recently been awarded a

contract for Quellaveco as part of the early works.

When do you thing the underground component of your business will really kick off?

Currently, underground activity represents less than 10% of our business, so we continue to explore ways to increase that capability. With the continued focus on larger scale underground mines, with improved safety standards and higher levels of mechanization, larger contractors will increasingly have opportunities to provide services, not just in Peru, but throughout the region.

How optimistic are you about the development of new mining projects in Peru?

The vibe in the industry is definitely more positive than in the last couple of years, with new projects moving like Quellaveco, Mina Justa and the expansion of Toromocho, among others. Having said that, I think this year we will have similar sales as last year. In 2017, we beat our target by 20%, but it was still a slower year than 2016. We are seeing a recovery but we do not expect to see explosive growth during 2018.

What are the opportunities for STRA-CON to enter markets outside Latin America?

Some of our clients come from North America and have projects there, so we see an opportunity to provide services in that region. It is obviously a very different market and one that we need to understand more about. Also, Africa is an interesting market that will continue to see a lot of mining development in the future.

Today, 45% of our business is conducted outside of Peru. The peak for us was 2014, when we had approximately US\$460 million in sales, with an international component of just 15%. Now, we have an aggressive target of reaching those levels again by 2020, but that will require diversification, both geographically and in terms of our service offering. We will achieve this via joint ventures and potentially through mergers and acquisitions as well. One of the great things about having Ashmore as a shareholder now is the financial strength that they carry and their capacity to invest in the growth of our business.



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Rómulo Mucho

General Manager
PEVOEX



What was your initial vision for Pevoex?

Our idea when we started Pevoex was to have a first-world company with the highest standards, providing high quality services. We are very honest and this has probably limited our growth. We do not work with the State and we do not pay bribes. By now, we should be a bigger company, but we are happy with the reputation we have in the market. We are a medium-sized player and we want to keep growing. The last years have been difficult, but today there are five important mining projects that are about to go ahead and we are participating with tenders in all of them. We may invest soon between US\$5 million and US\$10 million to enhance our fleet and be ready to serve these clients.



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What is your current scope and size?

We have 400 workers. When we started, we were focused on drilling and rock blasting activities, which is still our core, but now we offer the whole service in earthmoving, including tailings dam expansions. We can also do other construction activities and build explosive magazines, for instance. Last year, we had sales of about US\$25 million, which is lower than what we had when we were present in Las Bambas and Constancia but the downturn allowed us to learn and adapt in order to be more efficient with our people. At Milpo, for instance, 85% of our workers come from the local communities. This was a condition from the client and it was a big challenge for us, but after two years of training and hard work, we have an excellent workforce there and these people are now an asset for us and can do work in any other mine.

How do you think the regional elections will affect the mining industry?

The political parties have run out of credibility, so the elections are going to see a very atomized pool of candidates. All the main candidates are independent or have their own regional movements. In terms of mining, the issues are not related so much to economic disagreements, it is now an ideological problem of people who simply oppose mining development, and there are groups that use any excuse to destabilize the government. Mining companies are already doing a lot for the regions, but beyond their taxes and their CSR programs, it is the State's responsibility to step in.

How do you handle the safety procedures required to work in the mining industry?

We have an integrated management system, which has been a great learning process for us. After working with Las Bambas, Hudbay, Cerro Verde, Milpo and Antamina, among others, we have been able to improve our processes and adapt our safety standards. In Peru, I believe we use too much protective gear and sometimes that makes workers uncomfortable. Besides, in Peru we have not standardized the induction procedure to go to the different mines. There is a whole system around it which involves a lot of medical providers and a lot of money. Chile has already solved this issue, but in Peru this also prevents students to do internships in the mines, because the induction process takes more than a month and it is simply not feasible for them.

A Level-Playing Field

The corruption crisis has affected all sorts of providers within the construction field

If corruption has proven to be a deep problem for contractors when trying to win projects for public institutions, Peru's very open market for private investment pushed competition to the limits during the downcycle, when outsiders were desperate to win their first contract in the country, and clients were looking for the lowest costs possible.

Cristopher Varas, general manager of Grupo Vivargo, a local lifting and installation specialist, saw a number of its construction clients affected by the Lava Jato scandal, and also had to face very aggressive competition from outsiders. He related: "When the rates go below the average, you know that something is wrong. In Chile, companies really make sure that no-one offers a price that would result in safety issues later –in Chilean tenders you have bottomline prices below which you cannot even participate."

Varas said that during the crisis, he saw providers offering a 50% discount on the market average, especially foreign companies that just wanted to enter the Peruvian market. "At the end of the day, Peruvian companies that invest locally and obtain financing through the local bank lose an opportunity."

The situation was similar for many of Peru's companies in the metal-mechanic sector, that had to weather the double storm

of the lower levels of mining investment and the inability of the previous administrations to promote the much needed infrastructure projects. "Lately, there have been less projects of US\$10 million or more, and more players are competing for them. I have seen cases where 15 companies were bidding for the same project. Many of these players come from abroad and they are willing to lower their costs very aggressively because all they want is to have their first contract in the country," affirmed Juan Carlos Garcés, commercial manager of Imecon.

Luckily, there seems to be light at the end of the tunnel, thanks to the reactivation of mining investment. Earlier this year, even before Quellaveco's construction decision was announced, Grupo Vivargo had achieved a 90% occupation rate in its equipment rental fleet. "We are doing quite a lot of maintenance projects and we are also seeing good levels of activity in Chile, which creates synergies and allows us to move the equipment between the two countries depending on the demand", said Varas.

Quellaveco alone is a US\$5.3 billion investment, starting with US\$400 million in 2018, and the rest being spent between 2019 and 2022. This is fantastic news for all sort of construction-related providers for the years to come.



We are working on new technologies for better efficiency in the production of mineral within our spools and piping product range. That means making them lighter and more resistant, and increasing their durability. Particularly with the Humidur coating, not only do we provide much more durability, but also the process of applying the paint is much quicker than with other epoxy coatings.

- José Antonio Tord, general manager, Fast Pack





Cristopher Varas

General Manager

GRUPO VIVARGO



How has the business evolved over the last couple of years?

Although there were less projects in the market, we finished 2016 in a stable position. 2017, however, was a tough year for us. The corruption issues caused an impact on many construction companies, especially the largest ones that had been our clients for years. Also, in 2017 the largest international EPCM companies became less active; traditionally those companies were a good source of long-term work and good margins. As local construction firms embarked on a price war as a result of the market situation, the final price became the primary driver of the tender processes. This way, we saw projects with contractors that could not finish their job because they did not have the right equipment and certifications.

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Having said all this, 2018 has seen a good start, with some mining projects and a 95% occupation rate in our rental fleet, which is very good. Right now, we are doing quite a lot of maintenance projects, and we are also seeing good levels of activity in Chile, which creates synergies and allows us to move the equipment between these countries depending on the demand.

What are the main projects you have been working on?

In Peru, we continue to work in Las Bambas and Cerro Verde, while we also have small projects in Antamina, Toromocho, Quellaveco, Southern Copper and Marcona. We participated in the construction of Tambomayo too. In Chile, we have been working at Escondida's desalination plant, as well as other mining and renewable energy projects. We also work for some of Chile's large construction firms. This year, our biggest expectation in Peru comes from Quellaveco, Mina Justa and Chinalco's expansion.

Could you develop on your different business lines?

First, we rent and sell equipment. The rental side of the business is doing well, however the sales of the JLG equipment and the trailers have gone down significantly, because clients do not have access to financing. In terms of our lifting and installation services for construction projects, we have a wide diversity of telescopic and crawler cranes, so we can participate in large scale construction sites. We also offer heavy transportation services, with modular equipment that can load up to 200 or 300 metric tons per axis. Finally, a business that has seen good growth is our logistics service related to warehouse and inventory management, where we have served Las Bambas for MMG, and Toquepala, Ilo and Cuajone for Southerm Copper.

Could you provide more details about your logistics capabilities?

In warehouse management, we take care of everything from the moment the mine issues the purchase orders. We track all the goods all the way to the mine, we receive the items on site and we supervise that everything is in optimal condition. We then handle the storage and we provide a detailed account of any excess items that have not been used after a project is complete. Unlike other providers, we do not rent square meters of storage facilities; instead, we manage the client's facility and make sure all the items are good to be used. This service allows us to be present along the whole construction process and to have an open door with the clients to offer maintenance services after the construction stage.

91

Giovani Ugarelli

Managing Director

KAEFER KOSTEC



What were the main synergies created with the merger of Kaefer and Kostec?

Kaefer is a 100-year old company from Germany, and Kostec used to be a family company leader in Peru's thermal and acoustic insulation market. The merger combined Kaefer's global reach, technical expertise and lean construction methodology with Kostec's local knowledge. Kaefer Kostec is a global services company, active in over 50 countries, with a turnover of around US\$2 billion and over 28,000 employees. Our core business is the supply of thermal and acoustic insulation services for several industries.

What range of services does Kaefer Kostec offer?

Kaefer Kostec supplies thermal and acoustic insulation, provides fireproofing services and access services including scaffolding, which is also available for rent. On top of that, we have a surface protection business unit, well established in Kaefer Kostec's Brazilian branch. We perform electromechanical maintenance and general industrial facility services such as plant cleaning and gardening. Kaefer Kostec is in the process of expanding its services in Peru, with the aim to offer a wide-ranging service to industrial plants, tak-

ing care of everything that is not their core business.

How important is mining for Kaefer?

The oil and gas side of the business is where we have seen most work in recent years. In Peru we are currently executing a big contract in the Talara refinery, supplying 70% of the fireproofing scope for the project. However, we have just restructured our commercial department with a greater focus on mining. For the last five years, mining has represented 20% to 30% of our turnover. Looking forward, it should represent 50% to 60%.

How do Kaefer Kostec's solutions help miners meet safety regulations?

As most of the mining operations in Peru are at high altitude, the pipes that transport the water need insulating so the water does not freeze. Fire proofing of the steel structures is another key issue. Also, Kaefer Kostec's mission is to help customers minimize energy waste, and continuous innovation is key to achieve this. Our lean construction methodology constantly challenges the processes performed in the workshops and sites we are active in to ensure improvements even in the most successful projects.

Juan Carlos Garcés

Commercial Manager



What is Imecon's current strategy?

Our current vision is to keep a constant relationship with the main OEMs and contractors, for whom we can produce items such as flotation cells, thickeners and many others, but also we want to increase our direct business with the final clients. Thanks to this strategy, we have won contracts directly with Cerro Verde, Chinalco, Kolpa and Tahoe for Shahuindo. We are also participating in other tenders for Las Bambas, Southern Copper and the main EPCM contractors like Fluor, Bechtel and Ausenco. Besides, we have created our own project management office (PMO). We are looking at new ways of executing the projects across the whole process, from the financing instruments required, to the type of equipment and processes used for each project, in order to reduce costs. This year we are celebrating our 25th anniversary and currently we have more than 250 people.

Could you mention some of the main projects you have been involved in?

We recently did the EPC for the Stevia 1 plant in Piura. It was a project worth more than US\$10 million. At Inmaculada we did the paste backfill plant for US\$12 million. We only took care of the construction, but we did all the execution from the earthmoving to the commissioning, including the electrical equipment, the automation and the ancillary tanks. In the power sector, our main project recently was the pressurized piping system for Huanza, a US\$13 million project. We did the fabrication and installation, as well as the civil works. Other large projects include the fuel dispensers for Antapaccay and Las Bambas, and the fabrication and installation of all the conveyor belts for the mineral pier at the Matarani port.

What are Imecon's advantages in the mining sector?

We have a great position in the mining sector from a technical point of view. We have been working with clients such as FLSmidth and Outotec for many years. As a company focused on complex projects, many multinational companies have praised our quality control processes. We are seen as a specialist in both structures and equipment. Most of the other metal-mechanic companies have specialized in niches such as structures or tanks, but we have a wider scope.

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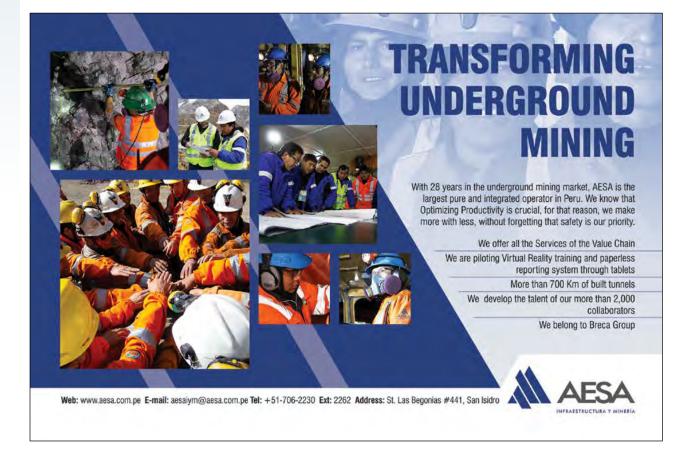
Specialized companies consolidate to manage larger projects, while general contractors keep an eye on new underground developments

The potential for new underground mining development is not to be neglected, and large contractors like OHL and STRACON want to increase their participation in this segment. The main challenge for the large players is that most of the current underground mines in Peru are in the small to medium size range. The country's largest underground operation is Cerro Lindo, with a daily processing capacity of 20,000 mt/d. The expected large underground projects will probably come from ageing open pits, like Yanacocha or, eventually, Antamina. Another interesting underground project is

Glencore's Coroccohuayco, where development work has already started.

In light of these developments, different players are already taking positions. Chilean company Mas Errazuriz, for instance, expects the Peruvian market to replicate the conditions of Chile's large underground mines soon. Diego Morales, general manager of Mas Errazuriz in Peru, said: "In Chile, mining companies look for a full-service contractor. Luckily, in Peru we start to see a move towards that model, with one single contractor that has strong financial capacity and higher safety standards."

An example of how the industry is favoring large, integrated underground contractors is AESA, part of the Breca group, probably the largest player in this segment with around 2,000 people working across seven projects. "The industry trend is towards consolidation," affirmed Mario Matuk, general manager of AESA. "We take care of a wide range of services, so mining companies can focus their resources on the long term planning of the operation, rather than having to deal with many different contractors. Productivity also increases when you have an integrated solution."





Mario Matuk

General Manager* **AESA**

*In August 2018, Mario Matuk was designated new general manager of Exsa, Breca Group's blasting solutions company



The industry trend is towards consolidation. AESA takes care of a wide range of services, so mining companies can focus their resources on long term planning, rather than having to deal with different contractors. Productivity also increases when you have an integrated solution.



Can you provide a brief introduction to AESA and its scope of mining services?

AESA has 28 years of operations in the market. We have seen impressive growth in the last decade, at an average of 21% per year. AESA is the largest pure, integrated, underground operator in Peru, and employs over 2,000 professionals working in seven different projects, with a fleet of over 140 drills and moving equipment.

Underground mining is divided across several parts of the value chain, and AESA offers a full service scope, including drilling, blasting, rock support, earth moving, pumps and long-hole production equipment. We also work in narrow vein underground mining with small specialized machines. AESA completes over 80,000 meters of tunnels and galleries per year. We work with mining companies such as Minsur, Volcan, Newmont and Nexa Resources, and also other service providers such as Robocon, Sandvik, Atlas Copco, Normet, Putzmeister and Resemin, to name a few.

How can increased consolidation between service providers benefit the industry?

The industry trend is towards consolidation. AESA takes care of a wide range of underground mining services, so mining companies can focus their resources on the long term planning of the mining operation, rather than having to deal with many different contractors. Productivity also increases when you have an integrated solution – it makes the operation more streamlined and straight-forward to coordinate.

When do you think larger underground mines will become commonplace in Peru?

The country is not used to very large underground deposits. However, we are starting to see such developments, like Glencore at the Coroccohuayco project. The global trend for mining is to move deeper underground, which is one of the reasons AESA has maintained substantial growth even during the recent mining downcycle. Many of the large open-pit copper producers will eventually develop their projects underground to take advantage of higher mineralization grades. From a social perspective, underground mining is also less invasive.

Mining fatalities have risen in recent years. What is AESA's approach to safety?

The main reason for AESA's impressive growth over the last decade has been our relentless focus on safety and productivity. Safety is AESA's highest priority, and we have reduced the index of accidents by 19 times over the last six years, so our results are tangible and significant. AESA has developed a culture of safety, with programs such as the 'Right to say no'. 'The Invincible AESA' is a corporate motto that underlines the emphasis we put on safety and our aim to reduce our accident index to zero.

How will the introduction of electrical equipment transform underground mining?

The electrification of underground mining will bring many advantages: it is environmentally friendly as it negates the need for diesel consumption, it will reduce the amount of ventilation necessary and its associated costs, and it will triple the working cycles with less maintenance. Traditional engines lose power at altitude because of a lack of oxygen, whereas battery operated machinery does not have this problem, which is a particular advantage in Peru. Electrical machinery is more relevant to underground mining than remotely controlled GPS equipment, for example, which works better in open-pit mines with greater access to satellite signal. AESA has partnered with General Electric (GE) to develop electrical scoops, and we are one of the first companies to introduce such equipment into mining operations. It will take time for the technology to mature – to reduce the size of the batteries and increase their power and duration – but we are already on that path.

What other innovations are driving change for AESA?

AESA is piloting a paperless reporting system where mine workers use tablets connected to Wi-Fi hotspots to enter data and write reports. AESA also utilizes data analytics to improve maintenance performance. In safety we are piloting virtual reality training using headsets, and identification technology that recognizes the training, licenses and passport documentation of the professionals working in the mines from their smartphones. Optimizing productivity for the mining industry will be crucial in the near future as the upcycle heats up and recruitment becomes an issue. Companies will need to do more with less, and in that sense, technological innovation is key.

Diego Morales

General Manager

MAS ERRAZURIZ



What is the history of Mas Errazuriz in Peru?

Mas Errazuriz is a Chilean company that has been in operations for nearly 40 years. Our first international project was in Peru at Antamina in 1999. Since then, we have had a continuous presence in the country. We have also done projects in other countries. We worked in Argentina at Cerro Negro for Goldcorp, and now we are back with operations for Glencore at Bajo de la Alumbrera. We also did work in Colombia at El Bodegón for AUX. Finally, we have been in Ecuador for a year now, participating in the Fruta del Norte project for Lundin Gold.

Beyond Antamina, in which other sizeable projects have you been involved with in Peru?

In Peru, we have done hydroelectric projects, underground construction, mining development and contract mining. Right now, we are executing the diversion tunnel of the Asana river for Anglo American at Quellaveco. Before this, we did some water intake, ponds and piping infrastructure for the same project. Besides, we have been very successful with the hydroelectric projects: we recently completed the 110-MW Quitaracsa

hydropower plant, with all the related infrastructure. This was right after we finished the 220-MW El Platanal hydropower plant.

How do you see the underground mining segment evolving in Peru?

In Peru, most underground operations are small or medium-sized, and operators tend to split the work among different contractors. So, very often you have a drilling contractor, a shotcrete contractor, and so on. Small mining is not a market in which we are able to compete because of our safety and quality standards. Our value offer is the integral underground development that is attractive to large mining operators with international standards.

In Chile, the industry is different and mining companies look for a full-service contractor. A company just requests its contractor to take care of everything and deliver the mineral in the process plant. Luckily, in Peru we start to see a move towards that model. There are two projects of great interest for us: Coroccohuayco and Yanacocha. Both companies, Glencore and Newmont, are part of that group of mining operators that really value an integrated service and that want to hire contractors with the highest standards.

Wilder Ruiz Conejo

President
JRC INGENIERÍA Y
CONSTRUCCIÓN



What is the history of JRC?

We started the Company with an initial focus on civil works and metal-mechanic projects for mining operations in Peru's central region. During our second year of activities, we started to work on underground mining preparation and development for Volcan at Yauli, and soon after, we had the opportunity to execute a sizeable project for Glencore at Los Quenuales consisting of an inclined shaft of 1,200 meters. Our performance in this project opened us the door to provide mining services in that operation and we took care of 80% of all the preparation, development and exploitation work at the Iscaycruz mine, where we worked for 13 years.

Over time, we have specialized in the integrated operation of underground mines. We handle all the tasks related to exploration, mine development, rock support, ancillary services, mineral extraction and transportation to the processing plants. As a result of this business model, we have already completed over 600 km of tunnels and extracted more than 16 million mt of mineral. We currently have five projects and we are adding a sixth one this year, after winning a tender.

We are bidding for other projects as well, so we expect to close 2018 with a growth rate higher than 10%.

What does the triple certification mean for your business?

Several years ago, we hired Bureau Veritas to implement the integrated management system under the three international norms: ISO 9001, ISO 14001 and OHSAS 18001. Since 2000, we had been working under the NOSA safety standard, but in 2013, we took the decision to go for the triple certification, which we achieved in 2015. This allowed us to improve our working standards in terms of discipline and quality in process execution across the board. Last year, we migrated to the last versions of ISO 9001 and ISO 14001, and right now we are updating our occupational health and safety management system based on ISO 45001:2018.

What is JRC's future strategy?

We have strategic plans for the short, medium and long terms. We are meeting our short and medium term goals as planned, while our long-term strategy is to continue grow-

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We have the triple certification and the capacity to serve them.

What is your opinion about the worsening of safety figures in Peru over the last couple of years?

There is a misconception about safety. Many see safety as an expenditure, but safety is an investment. With a safe environment, productivity rates will increase. In Chile, for instance, we use scoops with remote control, and this dramatically reduces risks for the operators. If the industry continues moving towards the integrated contract model, not only productivity will increase, but also the overall safety records in the country.

How do you think Mas Errazuriz is positioned in the market?

We see ourselves as a regional, Latin American contractor, but with world-class standards. We do quite a lot of work for Canadian clients because our standards are very similar to the ones they have. Besides quality standards, we are a technically strong company that delivers its promises and that is flexible with its clients. In Peru, we expect to grow by more than 50% between now and 2021.

ing through more integrated underground mining contracts, while we are also developing ancillary businesses such as construction projects, which is how the company started. In this context, we want to restart doing earthmoving works, infrastructure projects and related activities, such as tunneling for hydropower or road projects.

Considering how the industry is evolving, which changes do you anticipate in JRC in the years to come?

There are large open-pit mines that are already evaluating their move towards underground operations in the short and medium term, such as Yanacocha and Antamina, among others. We believe that the only way to tap into these opportunities is to introduce new technologies to execute massive, large-scale exploitation methods. Within that, the most important factor is training, and that forces us to transform JRC into a very agile and modern organization. As part of this evolution, there is already a process underway whereby the owners of the company will leave the executive positions in the hands of independent professionals.

Greg Jackson

Managing Director

BYRNECUT OFFSHORE



How have you been working with potential clients in Peru since the establishment of your alliance with San Martín?

San Martín has an excellent presence in the Peruvian mining and construction industries with a number of long-standing, established relationships with key clients. The San Martín/Byrnecut alliance will build on these relationships, offering potential clients high-speed mechanised underground mining options. This will include proven quality systems, structured training and the use of a large scale, productive modern mobile fleet and innovative technology.

The San Martín/Byrnecut alliance will add most value to operations developing excavations with dimensions of five by five meters and above. This eliminates manually intensive and physically higher risk tasks. To justify the significant investment in capital equipment, systems and training, contract tenures of three years minimum would be required.

How can large-scale underground mining improve safety records?

Large-scale mechanization removes personnel from the line of fire and reduces manual handling. Along with automation, where appropriate, this leads to reduced manpower

exposure and higher productivity. The excellent group safety record over time in Australia is replicated in Byrnecut Offshore contracts in third world African countries, where local mining knowledge is virtually nil in some cases.

How do higher commodity prices change mining contracts? Is there room to incorporate more modern technologies?

Byrnecut invests a lot of time and money to stay at the forefront of innovation and technology. This includes working with OEMs as a first user of various technologies, such as the Rhino slot drilling machine, the 22mt diesel-electric Joy LHD, and Sandvik's DD422i Intelligent twin-boom jumbos with automated drilling. Other examples of our investment in new solutions include realtime, 3D scanning technology to measure shotcrete thickness to apply design coverage and minimize wastage; mechanical fan hanging devices to eliminate personnel being in the line of fire; modern ejector trucks and R&D in alternative underground truck technology.

Also, having a leaky feeder installed for two-way radio communication has been fundamental to the rapid response required for high-speed mining supervision, traffic management and breakdown maintenance. From this communication backbone system, telemetry has also assisted in remote blasting, as well as ventilation and pump management. Autotram LHD technology is Byrnecut's preferred remote LHD operation, first introduced some 12 years ago, following on from conventional teleremote. The Byrnecut group has its own automation division for the supply, installation and maintenance of automation systems.

What are Byrnecut's main advantages, other than the size?

We offer a 'one stop shop' service, and we deliver. Through mechanization, we achieve more with less and will not compromise on safety or standards. Meanwhile, planned systematic maintenance with group wide online equipment data analysis provides for high equipment availability and controlled equipment unit costs. The use of fully automatic development jumbos along with emulsion and smooth wall blasting perimeter products result in development overbreak figures of around 5%, which is a significant reduction from industry standards of 10% or more. This in turn reduces ground support consumables.

Increasing Standards

JRC Ingeniería y Construcción, a Peruvian underground contractor, has grown over the years to provide integrated underground services. As part of this evolution, the company obtained the triple certification two years ago, and today has six running contracts around the country. Wilder Ruiz Conejo, president of JRC, explained that the company's strategy is also related to potential diversification, considering that JRC's history actually started in construction work: "Our long-term strategy is to continue growing through more integrated underground mining contracts, while we are also developing ancillary businesses such as construction projects. In this context, we want to restart doing earthmoving works, infrastructure projects and related

activities, such as tunneling for hydropower or road projects."

Another underground contractor that has set foot in the country is Byrnecut, through its partnership with local firm San Martín. The Australian company's business plan is to target underground mines that will require production faces of five meters by five meters, therefore large volumes, for which it plans to introduce the latest technologies, such as real-time 3D scanning technology to minimize shotcrete wastage, and mechanical fan hanging devices to improve safety, according to Greg Jackson, managing director of Byrnecut Offshore.

AESA, in partnership with GE, has also been investing in new underground technologies, particularly in the development of electrical scoops. "We are one of the first companies to introduce such equipment into mining operations," said Mario Matuk. "It will take time to reduce the size of the batteries and increase their power and duration, but we are already on that path. Battery-operated machinery do not lose power at high altitude, which is a particular advantage in Peru."

Beyond that, Matuk also described AESA's pilot project for a paperless reporting system, the usage of data analytics to improve maintenance performance and other initiatives related to safety, such as virtual reality training and identification technologies via smartphones to track each worker's training levels and authorizations to operate equipment.

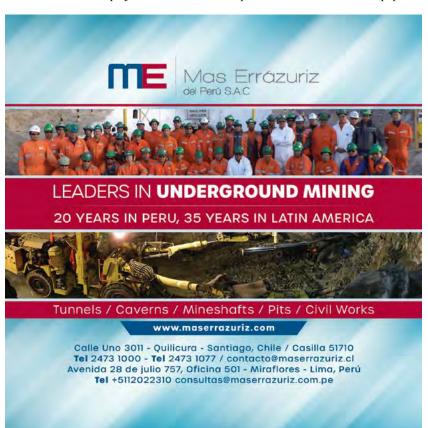
Ruiz Conejo of JRC agreed on the need for further mechanization and digitalization: "We believe that the only way to tap into these opportunities is to introduce new technologies to execute massive, largescale exploitation methods. Within that, the most important factor is training."

The aforementioned trends for larger underground mining also provide for a safer working environment. While achieving economies of scale and incorporating the latest technologies may imply a bigger initial investment, this will pay off in the long run, said Morales of Mas Errazuriz: "Many see safety as an expenditure, but safety is an investment. With a safe environment, productivity rates will increase."



Beyond the potential for large-scale underground mines discussed above, Peru already has a rich history in underground mining, with a wide variety of operations from the very small narrow-vein mines to highly mechanized medium-sized operations.

Robocon, one of the key contractors offering rock support through shotcrete application, is currently focused on narrower tunnel development, as per its clients' demands. "Typically, our clients have faces of four by four meters, but now they want to advance



PERU MINING 2018 Industry Explorations

in tunnels of three by three meters [...] Through Tecnomecánica, our technological arm, we are developing new machines in collaboration with other manufacturers in Peru and abroad that already have some technologies for narrow-vein operations," said Enrique Sattler, managing director at Robocon, a company that has been working for Volcan (now Glencore) since 2005 and for Pan American Silver's Huarón and Morococha mines since 2012.

Meanwhile Tumi, a raise boring contractor, has increased its involvement in production drilling thanks to the development of the SBM 400 SR machine. While raise boring has traditionally been used for ventilation needs, Marc Blattner, Tumi's general manager, explained the usage of the SR machine: "What we do is a burn hole: a hole in the center of the blast zone, which provides a cavity for the blast area to collapse into. The SR model is not only an upgrade of our traditional raise boring machine, but it is actually a new method of production which did not exist before."

In 2017, Tumi grew from 11 to 15 crews, three of which are dedicated to production activities, and is also expanding into Chile,

Today, drill and blast is still more economic than continuous mining. It is only after 4 km on a single line that tunneling machines become competitive, however the trend is to increasingly look at continuous mining methodologies, because you have new automation and mechanization improvements. At Ossa we have a 7-million euro R&D project to improve tunneling techniques.



- Adolfo Sicilia, general manager, **Ossa**

EDITORIAL =

where the company expects to grab boxhole contracts with Codelco at El Teniente. As a company that engineers and develops its own machines, increased mining activity worldwide may result in more revenues coming from the outright sale of equipment to miners, commented Blattner: "We will see Tumi's growth coming not just from contracting, but also selling machines into the Peruvian market, which so far we have tried not to do. It seems that the mines are going back to the mentality of the 1970s inasmuch as they want to buy their own equipment again."



Industry Explorations PERU MINING 2018 ■ NTERVIEW Global Business Reports



Marc Blattner

General Manager
TUMI RAISE BORING

What our SR machines do is a hole in the center of the blast zone, which provides a cavity for the blast area to collapse into. The SR model is actually a new method of mining production, which did not exist before.

How has the improved underground mining market given impulse to Tumi's business?

2017 was a stepping stone for Tumi. We grew from 11 machines to 15 machines working non-stop in contracts. Besides, our 400 SR and 700 SR machines that are used in mining production are starting to get some real notoriety. We currently have three SR machines working and we are building two more right now, as well as an additional machine for boxhole drilling that we are building for the Chilean market. This machine can do 2-meter upreaming holes, which is very large for a boxhole, but it is a very similar concept to our raise boring machine, hands-free and with very short set-up times (45 minutes).

How do you expect your Chile subsidiary to evolve?

We started Tumi Chile as a local contractor. Codelco does not hire directly from small contractors, so we are typically sub-contracted by larger contractors like Mas Errazuriz, Astaldi or Züblin. That being said, none of them have our technology. We are bidding on a project for 4,000 meters of slot raising at four meters of diameter, which also require an automated liner, and we also have that. This speeds up production times by 35 to 40%. Beyond Chile, we are also entering Canada, which is a humongous market for raise boring.

You currently export your machines internationally. Do you plan to sell them in Peru as well?

In the next three to five years, we will see Tumi's growth coming not just form contracting, but also selling machines into the Peruvian market. It seems that the mines are going back to the mentality of the 1970s inasmuch as they want to buy their own equipment again. I honestly do not think that is the right approach. It may work well for a jumbo, a scoop or a rock bolter, but raise boring is such a niche technology that you need the right operators, technicians, process and procedures. Having said that, if a company wants to buy the machines, we are flexible enough to offer ourselves to run the equipment with a contract, or provide all the maintenance, and also to train our clients' operators.

Which raise boring machines are in higher demand in Peru?

The 400 SR machines have been the most demanded in Peru, however the Peruvian market is getting bigger. We are currently building a 700 SR machine, which can do holes of 3-meter diameter instead of 2.1, and up to 4-meter diameter for shorter distances. Currently, at Cerro Lindo we do 2.1-meter holes by 35 meters in length, for around 250 meters of holes per month, with two machines. That is extremely fast. We call our machines 'SR', for slot raises, but what they actually do is a burn hole: a hole in the center of the blast zone, which provides a cavity for the blast area to collapse into. The SR model is not only an upgrade of our traditional raise boring machine, but it is actually a new method of mining production, which did not exist before.

Why do you think that Peru's safety ratio has worsened over the last two years?

The rate of production has increased and perhaps not all the safety measures have adapted to that. I find that most of the safety programs in Peru are just paperwork. You have to fill out 5,000 forms, but that does not translate into a safer work environment. It is only now that we have started seeing some mining companies looking at the implementation of the programs rather than the paperwork. At Tumi, we have changed the process, by automating the machines. With the SR machines we have not had one single accident so far, because the operator is removed from the piece of equipment which is remotely run. You have to think that each drill pipe of 1.5 meters weighs close to 1 metric ton. That presents risks, but we have an automated pipe positioner. On the SRs, we have created an automated feeder system, so the human is never in contact with the pipe, automatic upper wrench and lower wrench.

98

Alfredo Bazo

General Manager

MASTER DRILLING



What is Master Drilling's current footprint in the mining sector worldwide?

Master Drilling is a South African company with a global footprint and offices in Peru, Brazil, Chile, Mexico, South Africa, DRC, China and several other countries. Peru is the largest operation of Master Drilling in South America and the second largest globally after South Africa. From here we serve other countries as well, like Colombia and Ecuador, and our Peru office is also a training center for our workers all around South America. In Peru, we do raise boring for ventilation or production shafts all over the mine, with diameters that range from 1.5 meters to 4.1 meters.

Who are your main clients in Peru?

We have been working in all of Volcan's mines for 15 years non-stop. We also serve Nexa, Hochschild, Buenaventura, Sierra Metals and Condestable. We have a fleet of 29 rigs and 23 of them are working in Peru right now. All our clients are pretty aggressive to expand production, so the prospects for us are very good this year. We have a target to grow by 20% per year, this is why we are starting to offer new services, while

we are also diversifying geographically, trying to win more contracts in Ecuador and Colombia.

INTERVIEW =

What innovations have you introduced recently?

We developed a new service for mines where there are bad ground conditions. The idea is to provide the support on the raise bore before it starts collapsing. This way, we are able to do raise bores in places where this solution was not contemplated due to poor ground conditions. We bought the system from the U.S. and we are applying this solution locally.

Also, if we want to grow as a company, we need to start focusing on horizontal development, which is tunneling. At the Mining Indaba conference in Cape Town earlier this year, we launched a new mobile tunnel boring solution, the MTB. We believe that this is going to revolutionize the way mining is done. If you take a normal tunnelboring machine, it has a 200-meter backup system, whereas our technology is modular, with 20 meters for each module. It is going to be a quicker, continuous process, with less ground support.

Alain Dumont

CEO MONTALI



How can Montali's range of services help underground mining operations? Montali works directly for a number of

mining companies, such as Buenaventura and Poderosa, specializing in shaft sinking and raise mining vertically to depths of 500 meters. Since 2010, we have saved approximately 6,000 meters of raise bore. When many mining companies take out their drilling bit, they do not have sufficient ground support. We go in from top to bottom, install all the ground support necessary, and stop the infiltration of water. In recent times, we have seen an uptake in requests for trackless work. Montali has started to get into this, working with tunneling utilizing Atlas Copco equipment. It is necessary to have a good contract to perform such work. It is also vital that the operators and mechanics undertaking work of this nature are top quality.

In an industry where the rate of fatalities has risen, what is Montali's approach to human resources?

Montali's focus on hiring the right people and providing the best training is one of the reasons we have been active for almost 20 years in Peru. Safety is paramount when working in an underground mine and we have worked hard to ensure that all of our employees recognize this as the baseline of our philosophy. Training small teams on-site is much more effective than large groups in a classroom. I like to train young professionals when they are starting their careers. They absorb the information well and have not had the chance to pick up bad habits. When it comes to technology, they have grown up around this and it gives them a huge advantage with the move towards digitalization that we are seeing.

What are the key objectives for Montali in the next months?

We have an opportunity to build a trackless tunnel that is going to be excellent for us using state of the art equipment. This is a trend that will continue to grow as operations become more mechanized. We have just acquired a new Boltec, for instance. As the price of gold increases and the mining industry recovers from the previous downcycle, the stream of work coming in should rise steadily.

UNDERGROUND MINING PROCESSES

Sources: Mining Plus / GBR

DEVELOPMENT

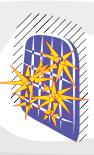
Tunneling activity to reach the ore body, using drill and blast.
Sufficient ventilation must be in place to comply with mining regulations.



using a jumbo.







Blast:

there are technologies to automate the loading of explosives, yet it is still common to complete this process manually.

Extraction of material:

using loaders.



using loaders



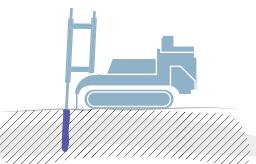
the most common tools are bolts, mesh and shotcrete



MINERAL EXTRACTION

Slot raises:

In long-hole open stoping, once the ore blocks (stopes) are exposed and ready to go, slot raises are needed to provide an area for the ore to expand into. This can be done through drill and blast, or with a raise boring machine.



Use of remote technologies:

In Peru's larger underground mines there are stopes in the order of 20 x 20 x 30 meters. To reduce the exposure of operators in non-supported areas, there are technologies to carry out the mineral extraction remotely.

Enrique Sattler

Managing Director **ROBOCON**



How has Robocon's business evolved over the last year?

We have worked for Volcan (now Glencore) since 2005, and today we have contracts at Yauli (with the Ticlio, San Cristóbal and Andaychagua mines); and Chungar (at the Animón and Islay mines). On these sites, we have cement plants and provide the shotcrete application service with a fleet of specialized equipment. Besides, since 2012, we are present in Pan American Silver's Peruvian mines, Huarón and Morococha, where we have cement plants and we also provide cemented backfill and all the shotcrete service. More recently, we started operations in Tambomayo and Uchucchacua for Buenaventura, and we began working in Yanacocha in 2017, in collaboration with AESA. Our most recent client is Austra Duvaz, where we are transitioning from a dry shotcrete operation to a mechanized, wet shotcrete operation in narrow tunnels.

What is your strategy for 2018?

Our main project right now is to be able to serve our clients as they increasingly move towards narrower tunnel development in their mines. Typically, our clients have faces of four by four meters, but now they want to advance in tunnels of three by three meters. This requires new, smaller equipment to work there and, through Tecnomecanica, our technological arm, we are developing new machines in collaboration with other manufacturers in Peru and abroad. As an example, we are bringing small mixers from India for these small tunnel sections.

How are you moving towards an integrated ground support approach?

We have an integrated proposal: we supply the cement, the additives (for which we have an agreement with a major supplier), the concrete plants, the quality control, the shotcrete transport and application, the scaling service, and the rock bolters, to provide an end-to-end solution in ground support.

What is Robocon's approach towards safety?

Due to the higher demand for personnel in the industry over the last year, there has been quite a bit of rotation. This is associated to higher levels of accidents, because workers need to get used to new mines and new working conditions. Also, the pressure to increase production to take advantage of the higher metal prices can also lead to more accidents.

At Robocon, we have not had any serious incidents over the last 10 years. Since 2008, we have implemented structured safety systems and we improve our record every year. Three years into the program, our accident rates had been reduced by more than 90%. With these programs it is very easy to improve the numbers during the first years, but once you reach a certain level and the goal is zero, it is a real challenge. We are already at that stage, and the next step will be obtaining an ISO certification.

Could you summarize the main developments you expect this year?

The main development for Robocon this year is the service for narrower tunnels and the development of specialized equipment for that. Also, we plan to continue installing slick lines to bring the shotcrete down the mines; in collaboration with the mine we are involved in building a 500-meter slick line at Chungar through Tecnomecanica right now. Another development is the introduction of our scalers and the widening of our services to provide a more comprehensive ground support solution. We also want to consolidate the business of shotcrete additives sales through a collaboration with a major supplier.







OEMs keep incorporating new concepts to improve productivity and safety

104

The mining industry is constantly evolving. If the last downcycle was fertile ground to look for new ideas that would bring more efficiency to production processes, the current upswing in commodity prices may offer the perfect opportunity to properly test those new technologies. At the end of the day, there is more cash available in the market, and final users may be a bit more flexible with their budgets to give the latest gadgets a try.

For the global original equipment manufacturers (OEMs), innovation is a long-term pillar with a clear strategy. Epiroc, the newly-created company that is taking over Atlas Copco's mining business, has defined four areas of interest for innovation: electrification and the use of battery-powered equipment; automation, related to the possibility of having remote operations; interoperability, with all machines compiling big data that will allow for fast decision-making; and technologies for rock excavation, with the idea of potentially replacing drill-andblast methods with continuous mining tech-

Ángel Tobar, general manager for the Andean region at Epiroc, developed on the

CATERPILLAR **TOTAL FLEET IN PERU: 658**

LARGE MINING TRUCKS Sources: Ferreyros, KMMP

Cat 797F

Payload capacity: 400 short tons (363 mt) Units in Peru: 111



Cat 794AC

Payload capacity: 320 short tons (290 mt) Units in Peru: 4



Cat 793

Payload capacity: 250 short tons (227 mt)

Units in Peru: 277



KOMATSU

TOTAL FLEET IN PERU: 339

Komatsu 980E

Payload capacity: 400 short tons (363 mt)

Units in Peru: 14



Komatsu 930E

Payload capacity: 320 short tons (290 mt)

Units in Peru: 232



Komatsu 830E

Payload capacity: 250 short tons (227 mt)

Units in Peru: 54





"We would like to try in Peru the Belaz 7571 model, the world's largest mining truck with a payload capacity of 500 short tons. Altitude would not be a problem - the main challenge perhaps would be the width of the roads when making u-turns. In any case, we also have the Belaz 7560 model, with a payload capacity of 400 short tons."

> - Mario Rabines Salmón. general manager, **CT Power**



LEADING SUPPORT FOR WORLD-CLASS MINING

advantages that battery-powered equipment can bring to the mines, especially as underground operations move deeper and health, safety and environment (HSE) regulations worldwide become more stringent: "At this moment, the initial cost of a battery-powered machine is higher, but if you look at the total cost of operation, you can obtain significant savings in areas such as mine ventilation, by having smaller tunnel sections, and also you would avoid the operational delays related to fumes underground," he explained.

With regards to continuous mining, Gonzalo Díaz Pró, general manager of Ferreyros, the Caterpillar distributor in Peru, explained the impact that this mining method could have on the industry: "Foregoing the need for blasting is the dream of all miners, because blasting drives the whole extraction process: you need to clean up, prepare, evacuate, blast and go back." Over the years, especially since Caterpillar's DBT acquisition, the brand has been investing in this field, and it is already testing a continuous mining prototype for hard rock in Chile. Caterpillar also has a significant presence underground with its family of load-hauldump machines (LHDs). Díaz Pró related that the brand has incorporated technologies such as sensors, payload systems and rear view cameras, yet he added that Caterpillar will only launch battery powered LHDs at a commercial level once this technology is able to perform as well as diesel engines. Komatsu Mining Corp., the company created from the merger of Komatsu and Joy Global, is also in a great position to push its technological developments across a wide

variety of machines involved in mining, from the Komatsu trucks and construc-

Over 1,000 24/7 on-site employees field support working and in Peru living at mine sites More than 500 off Highway trucks operating in the country The largest inventory of spare major parts and components in the market The biggest network of repair shops in Peru Specialized training and technology services for Mining The most comprehensive product line for Mining

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José Marún, Takaaki Kitabayashi & Carlos Fonseca

JM: Former CEO
TK: CEO
KOMATSU-MITSUI
MAQUINARIAS PERÚ
CF: General Manager
KOMATSU MINING CORP.







What is your strategy to improve your position in the market?

JM: We have focused a lot on the aftermarket business, with improved services on-site for our mining clients, and increasing our absorption ratio significantly. In construction, there has been a lot of activity related to small projects in mining, with tailings dam upgrades, road improvements, power infrastructure, and others. In 2015, our market share in the construction business was just 3%, and today we have a 24% participation.

Which equipment models do you expect to be the flagship moving forward?

JM: As capital investment returns with new greenfield projects, we see a lot of opportunity in our Komatsu 980E truck, the only electrical truck with a payload capacity of 400 short tons in Peru. Nine of these trucks have already been acquired by Antamina, Toquepala and Cuajone. In total, we have nearly 300 mining trucks in Peru, a majority of which are the 930 model with a payload capacity of 320 short tons. If you look at the market of 300-short ton trucks and above, we have 65% participation in Peru. CF: As copper prices have stabilized, our sales have picked up in that space. We work directly with mining companies such as Anglo American and Grupo Mexico. We have had a strong participation in the Toquepala expansion, and other recent sales include two shovels purchased by Cerro Verde that we are assembling this year, and a loader for Chinalco. An area of focus for us this year is the largest P&H shovel available, the 4800, and the largest Komatsu truck, the 980. Together these machines have exciting potential.

What are the synergies created with the former Joy Global structure for an improved offering and better service?

TK: We are already collaborating with Komatsu Mining Corp to obtain better economies of scale and logistics synergies. Service is our main source of income: over the 10-year life of mining equipment, we can foresee the needs for repairs and overhauls, which allows us to invest in our infrastructure in Callao and Pucusana, as

we have done over the last three years. We can also plan our training programs, where we collaborate with Senati, together with Komatsu and Cummins.

CF: In Peru we already work very closely together. For instance, Cerro Verde has a program with KMMP to transfer 50 930 trucks from Indonesia. We do a complete overhaul for these trucks in our facility in La Joya, and then KMMP assembles the trucks before we deliver them. From a practical standpoint, we are operating as one Komatsu.

What needs to change in order to have your autonomous trucks running in Peru?

TK: The autonomous trucks are already working in several countries, but in Peru we still need the legislation to evolve a bit. We have already informed the current administration about the need to review the current regulatory framework, to identify any potential gap that should be filled to allow for autonomous trucks to be introduced in Peru. Chile, Australia and Canada already made some adjustments to their framework to allow for the operation of autonomous trucks in aspects such as safety, communications, insurance requirements and others.

What technological advantage does the Joy equipment have in the underground segment?

CF: The underground sector has been a strategic focus for us for the past two years. We have a four-mt Joy loader, the 4LD, which is very robust, fast and easy to maintain. Also, our Montabert attachments are extremely efficient, offering a 20% increase in production compared to other drill attachments. Then, we have our SR (Switched Reluctance) technology included in P&H wheel loaders and our larger Joy underground loaders. It consists of the ability to recapture energy when you put the brakes on, like in hybrid vehicles, or when you lower the bucket. The SR system captures the energy in the spindle, which can be applied to propel the wheels. This technology is targeted to be included in other Komatsu products in the future.

PERU MINING 2018

KOMATSU 980E

THE ONLY ELECTRIC DRIVE MINING TRUCK
WITH A 400 SHORT TONS
PAYLOAD CAPACITY
IN PERU



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<< 105

tion equipment to the P&H shovels, Joy underground equipment and Montabert drills. Carlos Fonseca, general manager of Komatsu Mining Corp. in Peru, gave more details about the SR (Switched Reluctance) technology included in the P&H wheel loaders and the larger Joy underground loaders: "It consists of the ability to recapture energy when you put the breaks on, like in hybrid vehicles, or when you lower the bucket. This energy can be applied to propel the wheels. The feedback we have received is that it is very fuel-efficient and low on maintenance. This technology is targeted to be included in other Komatsu products in the future."

The expected development of several mining projects in 2018 and 2019 with a combined capex of several billion dollars presents enormous opportunities for equipment manufacturers. In the case of Komatsu, the company had a significant participation in the Toquepala expansion, and has also recently sold two shovels to Cerro Verde. "An area of focus for us this year is the largest P&H shovel available, the 4800, and the largest Komatsu truck, the 980. Working together, these machines have exciting potential," said Fonseca.

How did mining help Ferreyros' business, considering the difficult situation in the general construction segment?

2017 was a very good year for Ferreyros, in spite of the market's contraction. The El Niño phenomenon caused lots of damage but also brought an expectation about reconstruction activities that did not come to fruition in the end. The construction market was particularly impacted by the social, political and economic context, and that reduced business volumes.

However, the growth of the mining industry helped offset this negative trend with higher metal prices. Since the beginning of 2017, we saw more dynamism in underground mining, with companies willing to look at a longer-term picture for maintenance planning, especially the larger miners. By the second half of the year, the surface mining segment also reacted positively, with Southern as the first company to increase its fleet, and others following shortly after that. Looking at the 12-month period ending April 2018, we had an 80% market share in large trucks and LHDs. We have more than 110 CAT 797F trucks (400-ton [363-mt] payload) operating in Peru that have already moved 1.7 billion short tons of material.

Do you plan to include electric transmission at some point for the 400-ton truck model?

A few years ago Caterpillar bought the Terex/Unit Rig mining trucks, which already had electric transmission models with payload capacities of 250 short tons and larger. Our 794 model, with a capacity of 320 short tons and electric drive, is a heritage product from that acquisition. It has been running in Peru with excellent availability and speed. Caterpillar knows that some customers are more familiar with electric drive trucks and, moving forward, the idea will be to offer the full range of mechanic and electric drive models, to suit all the needs of the market.

How much is Caterpillar investing in continuous mining technologies?

Continuous mining, or foregoing the need for blasting, is the dream of all miners. Blasting conditions drives the whole extraction process: you need to clean up, prepare, evacuate, blast and go back. In coal and other materials you can do continuous extraction, but in hard rock mining we are still to see a solution that is applicable at a commercial level. Several brands are moving in that direction. When Caterpillar acquired Bucyrus, it also inherited a company called DBT, from Germany, and solutions for continuous coal mining that Bucyrus already had. Over the years, Caterpillar has been investing in R&D. Nowadays, Caterpillar is testing a continuous mining prototype for hard rock.

What has been the impact of your new repair center in La Joya?

We completed the US\$30-million facility in late 2017. We moved the operation we had in Arequipa to La Joya, and we already have 250 people working there. To date we have already doubled the capacity we had in Arequipa, and this year, this facility should have similar production levels to our center in Lima. Today, between Lima and La Joya we produce 2,700 major components per year in a context where there is a scarcity of spare parts worldwide. With the global mining downturn during the 2013-2016 period, most sub-suppliers and foundries had reduced capacity and now it is a bit of a challenge to meet the world's demand. Also, our La Joya investment is a significant milestone towards the promotion of a mining cluster in southern Peru.

Could you tell us about your overhaul project for large shovels?

The large electric shovels that we inherited from Bucyrus are the largest piece of equipment we sell. With partial repairs they have a life of around 100,000 hours, after which they are retired from activity. However, last year, we did the first full overhaul of a large rope shovel -with 100,000 hours- ever done by a Caterpillar dealer worldwide. It was a large shovel operating in Toquepala, which we rebuilt completely, providing a new operating life of around 50,000 hours. It was a huge task with zero accidents, but not only was it important for our customer, it was also a rewarding experience in line with our sustainability initiatives to promote recycling and reduce industry impact.



Ángel Tobar

General Manager Andean Region **EPIROC**

The batteries are increasingly well adapted to the demanding environment of the mining operations, but there are also transitional solutions, such as the use of swing units, where you have a second battery being charged while you are using the first one.

The replacing time is just 10 minutes, so you have nearly a 100%



availability.

What is the challenge to rebrand Atlas Copco as Epiroc?

Atlas Copco is retaining the industrial business, and Epiroc is focusing on mining. To position the new brand is obviously a challenge, but we have a history spanning more than 140 years, with a well-established culture, values and processes. With that in mind, the split of Epiroc looks at having a closer relationship with the clients. We are very strong in drilling, ground support, loading and hauling.

How does innovation help you adapt to the new market demands?

We see four main areas of interest to develop the mines of the future. These are: electrification and the use of battery-powered equipment; automation; interoperability; and technologies for hard-rock excavation. To put this in context, the easy-to-mine deposits have already been exploited, so what you have is deeper deposits with narrower veins and more difficult access. On the other hand, legislations in the different countries are setting more constraining standards in terms of health, safety and the environment. All this creates the need for different technologies and at Epiroc we are working on machines that will be free of emissions. This includes replacing diesel engines with battery-powered ones. At this moment, the initial cost of a battery-powered machine is higher, but if you look at the total cost of operation, you can obtain significant savings.

When do you think this technology will be widespread in underground mining?

The batteries are increasingly well adapted to the demanding environment of the mining operations, but there are also transitional solutions, such as the use of swing units, where you have a second battery being charged while you are using the first one. The replacing time is just 10 minutes, so you have nearly a 100% availability. If you combine that with the fact that you no longer need to wait to enter certain areas as there are no fumes, the solution certainly offers important advantages. In terms of the battery-charging technologies, we believe that these should be standardized across the board so that chargers can be used in a similar way to cellphones, regardless of the brand.

What items do you already have with the battery option?

80% of diesel consumption within a mining site is related to two main activities: the haulage and the transportation. In 2012 we started developing the battery-powered Scooptram ST7. Last year we did the global launch of this product at Condestable. Now, we are doing the first tests with the ST7 in altitude conditions at Atacocha. Besides the Scooptram, we also have battery-powered Dumpers, Boomers and Simbas for production drilling.

Will continuous mining be able to replace drill-and-blast in hard-rock environments?

The continuous mining method traditionally used in coal or potash operations is far more efficient than the drill-and-blast technique. We have been developing technologies for several years in collaboration with Anglo American and Rio Tinto, and we already have some continuous mining technologies in platinum operations in South Africa, operated by Anglo. While blasting is still the main solution for hard-rock environments, we should not rule out the use of continuous mining in the future.

Could you develop the ideas of interoperability and automation from Epiroc's perspective?

We live in a connected world, and mining should not be an exception. Clients need to take decisions very rapidly, online, regarding their fleets and systems. Our machines have the Certiq technology that compiles lots of data and enables for better decision-making. Recently, Epiroc has also incorporated a Swedish company, Mobilaris, that designs systems to compile data related to equipment, people and objects within the mine.

With regard to automation, if you can operate the mines remotely, people will be far less exposed to risks. Also, you will increase productivity, because it is easier to repeat a good task (a good drilling mesh, for instance) if you can automate the process with the support of a computer. In Stockholm we had machines operated from 200 km away, and also in Australia we operated a mine from far away. Another example of how automation and remote operation can boost productivity is the risk of thunderstorms in open-pit mines. If you operate the mine remotely, you can keep the operation running.

Industry Explorations

Giorgio Mosoni T.

Chief Strategy Officer IPESA



Can you give us some background about IPESA?

IPESA has been operating in Peru uninterruptedly since 1979. We represent John Deere Ag & Turf since 2003, and John Deere Construction since 2006. Since that year, IPESA has been steadily building market share, moving from 3% in 2006 to 17% in construction machinery at this time. Then, in 2015, IPESA became the official dealer for Wirtgen Group in Peru, which expanded our offering to



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the entire road construction cycle: processing, mixing, paving, compaction, and rehabilitation. This also allowed us to expand our footprint in the mining industry; primarily with the Kleemann brand, worldwide technology leader for crushers, screens, and materials handling.

How are the different business entities within the IPESA business group separated?

The business group is conformed of four different companies that operate under the IPESA umbrella. IPESA is dedicated specifically to the sale and commercialization of new equipment. CGM Rental, our sister company, was founded in 2010, and is an expert in the rental of construction equipment and the sale of used equipment. IPESA Hydro is dedicated to irrigation solutions and water technologies within the mining sector. Finally, Italtrac Selva commercializes new equipment in the Amazon region of Peru.

What is your presence and competitive edge in the mining sector?

At least one of IPESA Group's business entities is present in most of the major mining projects in Peru, including Cerro Verde, Quellave-co, Toromocho, Las Bambas and Pacasmayo, to name a few. In most projects we are present with Kleemann crushing equipment and John Deere machines for earthmoving. CGM Rental has an important presence in most mining projects in Peru as well. That being said, we consider our Parts & Service divisions most critical to our growth and success. Our focus and dedication in after-sales support has allowed us to routinely attain 95%-98% mechanical availability for our machines. Over the last two years, IPESA has invested heavily in expanding this area of the business, and we are building a new hub in Arequipa.

John Deere equipment has outstanding performance at high altitude, which is vital in Peru. Furthermore, our machines offer greater productivity and lower operating costs in terms of fuel consumption. IPESA's growth has been tangible despite strong competition. The creation of CGM Rental was an important strategic move, as it allowed us to provide customers with the opportunity to try out John Deere machinery and experience these competitive advantages first-hand.

Which technological innovations do you see driving growth for IPESA?

IPESA is committed to promoting new technologies and change the way mining is done in Peru, particularly through Wirtgen's Surface Miners. The current blasting and crushing process is labor intensive, time consuming, and expensive. Wirtgen Surface Miners are akin to a giant road milling machine, which mills the surface of the mine pit to specific depths to extract the layers of different minerals more precisely. There have been only two surface miners operating in the country so far, but it is a technology that is already commonly used around the world for copper, iron, coal, and phosphate mining. IPESA also offers the JD LINK Monitoring service, an innovative solution that uses a GPRS signal instead of a satellite to track the equipment in real-time. It constantly monitors the state of the machine, offering preventative maintenance and alerts. It tracks fuel consumption, hours of use, and documents the productivity of the machine and its operator.

110

Image courtesy of Volvo



Construction and Ancillary Equipment

Demand is increasing for all sorts of machines required for mining and construction projects

New mining investments also represent a great opportunity for manufacturers specialized in construction equipment. Volvo Peru, for instance, offers the FMX trucks, widely used in earthmoving activities, as well as the whole range of its Volvo Construction Equipment line. In 2014, Volvo acquired the mining truck business of Terex and, from April 2018, these units will be sold under the Volvo brand for the 45 to 100 short ton range. "2017 was very positive as we sold to key customers that already had Volvo trucks but not Volvo construction equipment. In 2018, we expect a positive continuation of this trend with a favorable mining environment and the commencement of new projects like Quellaveco," affirmed Enrique Ramírez, VCE business director at Volvo Peru.

Looking specifically at dump trucks for construction, the market is finally picking up after several years of consistent decline. José Antonio Heredia, manager of the truck division at Divemotor, the distributor handling Mercedes-Benz, indicated that we face a better business climate, even if the market is still far from the 2,500 dump truck units sold annually during the peak moments.

Divemotor has a new Mercedes-Benz truck coming up for earthmoving and off-road requirements called the Arocs. Heredia provided an update about the new features of this model: "The new Arocs includes the Turbo Retarder Clutch, a hydraulic system that gives the driver greater reliability to overcome the steepest inclinations when the truck is loaded. The system allows for an average higher speed, which means that the cycle times are reduced, and therefore productivity increases."

Compressors and Ventilation Systems

Sullair del Pacífico, the company that distributes and services the Sullair compressors in Peru, is also expecting growth from

113>>

Industry Explorations

How is the mining market evolving?

The mining industry requires three types of vehicles: dump trucks, tractor trucks for fuel or concentrate transportation, and vehicles to move personnel around. We already have a high participation in the mining industry, so we want to keep that market share and we also expect to grow with the new projects. Not all greenfield projects will bring incremental output, because there are also other projects declining, but for sure Quellaveco is going to add more volume to the industry. Depending on how quickly the new projects are developed, we could see a 15-20% increase in the size of the market.

From a product development perspective, what are the key areas of focus of Mercedes-Benz?

The Arocs is our latest generation dump truck. It has a similar load capacity to the previous models, but offers lower operational costs and increased safety and environmental standards (our trucks come now with Euro 5 standard). In terms of the tractor trucks, we are the leading player in mining, with a combination of our Mercedes-Benz and Freightliner brands. There, we are now offering better engines with the Euro 5 standard as well, providing for lower emissions and fuel consumption.

Andrés Leonard

Managing Director **SCANIA**



What has been the impact of the new Scania Heavy Tipper?

This truck is unique in the market: not only can it carry up to 25% more load than any other comparable truck, but also it keeps the same operating expenses per tonne. All key profitability indicators improve substantially. When you analyze the tonnes • km / gallon ratio, we have reached improvements up to 15% compared to traditional tippers operating in mines with different levels of TC (Traction Class). With this vehicle we should quickly capture more than 20% of the mining and construction segment in Peru.

How does Scania look at sustainability?

Sustainable transport is based on three pillars: energy efficiency, alternative fuels and electrification, and autonomous and smart vehicles. In Peru, we are promoting the use of natural gas and biogas. Peru is transitioning from Euro 3 to Euro 4 fuel quality standard, but at Scania we are going directly to implement Euro 5. We are planting a tree for every vehicle we sell – the Scania Forest we are creating will contribute, in five years, to the absorption of 2% of the CO2 emissions produced by vehicles in Peru. Also, by 2020, all Scania production plants worldwide will work on 100% solar energy.

Jorge Masías

Truck Sales Manager **VOLVO**



What are the main truck product lines that Volvo offers in Peru?

We have 25,000 trucks in operation in Peru, including Volvo and Mack. For Volvo, we have three main lines: first, the medium-heavy trucks that are mainly used for general transportation activities, as well as for ancillary works in mining and construction. Secondly, the tractor trucks for all sorts of transportation. Finally, we have the rigid heavy trucks, where the main product is the FMX dump truck. With regard to Mack, we mainly distribute the tractor trucks for road transportation.

How is the dump truck market evolving?

In the dump truck segment, we have a 45% to 50% market share. The size of the pie had been decreasing since 2012, yet we are seeing growth again this year. In 2017, we sold 570 dump trucks, of a total market of around 1,200 units. Over the first four months of 2018, we have seen 20% growth in our sales. Growth is being driven by the constant renewal of fleets, and new projects like Quellaveco. Underground mining represents 15% to 20% of our sales for mining-related trucks. There, we see a trend for larger trucks, because mining operators have a need for the reduction of traffic underground.

112

<< 111

the mining industry. Its general manager, Richard Rodríguez, explained that compressors are present across most mining and industrial processes, from the point of mineral extraction to the processing plant. "Compressors represent a small investment if compared to other capital equipment, but they are a critical element of the whole process, because if you have a compressor failure, you need to stop production," he explained.

Globally, Sullair was recently acquired by Hitachi, and Rodríguez affirmed that the merger is going to create very interesting synergies: "Hitachi has a whole set of solutions in terms of remote monitoring, connectivity and others. The combination brings the best of both worlds. American equipment has always been very robust, while Japanese companies are experts in introducing the latest technologies."

Finally, a key aspect in underground mining is ventilation, and this is a need that is not going to go away, even if battery-powered machines become widespread. Soren Cánepa, co-general manager of Airtec, a local manufacturer of ventilation systems, affirms that underground mines will always have to deal with other gases naturally produced by the operation, as well as dust and high temperatures.

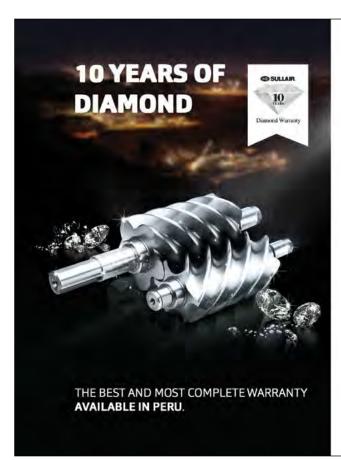
Over half a century Airtec has produced more than 15,000 fans in its facility in Callao. Cánepa highlighted that the trend now is to move towards ventilation on demand (VOD). He gave more details: "Through automation solutions, VOD looks at reducing the unproductive hours caused by blasting processes, gases or high temperature. This is achieved with a total control of the fans, depending of the levels of activity in each section of the mine."

Our most successful project in automation was developed together by Rockwell Automation for Goldcorp's Marlin mine in Guatemala. We automatized all the fans to a SCADA standard, with real-time control from the surface. This allowed us to be one step ahead in terms of predicting maintenance needs, and ventilation-related problems were reduced to close to zero.









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Industry Explorations



Richard Rodríguez

General Manager
SULLAIR DEL PACÍFICO

Compressors represent a small investment if compared to other capital equipment, but they are a critical element of the whole value chain, because if you have a compressor failure, you need to stop production.

What is the vision of the current owners of Sullair del Pacífico?

Sullair del Pacífico has been in the market for over 30 years as one of the leaders in compressed air systems. We are Sullair's most important distributor in South America, and the only distributor in Peru that handles Sullair's full portolio. In 2015, the company was acquired by a group of investors from Ecuador, with over 50 years of experience in different sectors. Sullair has a great reputation as a company that is very solid and very agile, offering fast response times. We are also very flexible to work with the clients on specific applications or requirements from them.

When we took over the company, there were a few bottlenecks on the service side, and we implemented some improvements by hiring more personnel, giving more training and establishing key performance indicators to improve efficiency. Also, we opened up our first branch outside of Lima in Chiclayo, where we serve both the mining and agro industries. This year, we plan to open an office in Arequipa as well, a region where mining is a key driver.

Globally, Sullair was acquired by Hitachi last year. What synergies are going to be created with this merger?

Sullair is an American brand and last year the Sullair Group was acquired by Hitachi. This is going to make Sullair one of the world's top two manufacturers of air compressors. Hitachi is bringing tremendous technology and experience to the table, with a whole set of solutions in terms of remote monitoring, connectivity and others. The combination brings the best of both worlds. American equipment has always been very robust, while Japanese companies are experts in introducing the latest technologies. I am sure that the best of Sullair is still to come.

Overall, how important is mining for your business?

When the mining industry is doing well, it can represent at least 40% or 50% of the total sales. This year, we anticipate that mining is coming back and will be the most important industry for us. We are in close contact with both the mining companies

and the main engineering houses. We have a close relationship with Buenaventura, Cerro Verde, Volcan and Antamina, and more recently we have started working with Southern Copper.

What are your main product lines in mining?

Our TS line is our flagship in mining. It is the most efficient compressor in the market in terms of energy consumption. It is a stationary unit, of which there are more than 300 working in Peru. Besides, last year we launched our new LS series, that comes with all the latest technological developments, including a large screen to monitor all parameters of the machine. We now want to promote the larger LS models in the mining industry.

What stages of the mining value chain require the use of compressors?

Compressors are present across most mining and industrial processes, from the mining side of things (shovels have compressors, for instance) to the processing plant. Compressors represent a small investment if compared to other capital equipment, but they are a critical element of the whole value chain, because if you have a compressor failure, you need to stop production.

Peru is a dynamic market, where you have all the main global brands. In this context, the quality and durability of the machine are essential, because clients can compare it with other options. In this respect, having machines that have been working in some mines for 20 or 30 years is our best letter of introduction.

At Sullair del Pacífico you are now representing Kito. Could you give us more details about this new business?

Kito is a leading manufacturer of material handling equipment, especially cranes and hoists for all industries, and it is well known in the mining sector. It is a Japanese brand that our mother company in Ecuador has been representing for 50 years. Kito has several types of hoists, manual or electric, explosion-proof, so we can adapt to any market requirement. It is an ideal complement to our current product range with the compressors.

Equipment Components

The details make the difference

The development of new projects will have an effect on expanding the different fleets across the board, offering opportunities as well for companies specialized in equipment components. Fundición Chilca (FUCSA), a recent new foundry investment in Peru, has set up capacity to provide items for both processing plants and mobile equipment. "During the downturn, the price of mill liners went down significantly," related Raúl Ferrero, general manager of FUCSA. "We expect that to change in the near future, but in the meantime we are focusing on other products."

Specifically in the mining truck segment, Austin is a company specialized in the design and manufacturing of truck bodies and buckets. The company's latest product is the JEC LD tray – Tim Mitchell, VP business development South America at Austin, gave more details about this product: "We have optimized the JEC LD by reducing the tray weight, which has a significant effect on the payload. Over the long run, the difference in productivity is huge, and can result in production increases in the millions of tonnes."

Another important part in mobile machines and industrial equipment is the drives. Bosch Rexroth, a German company with a leading position in hydraulic drives, has been expanding its service capability in Peru over the last years, through the acquisition of a local distributor. Now, the company will continue capitalizing on the after-market opportunities, but also will push for the introduction of new solutions locally. Kai Rothgiesser, general manager of Bosch Rexroth, explained that the company sees a lot of opportunity in Industry 4.0: "By recording all the parameters of the different machines and components, you can make sure that the operation is running at an optimal level and that you can anticipate maintenance."

Mining already represents 50% of Bosch Rexroth's business in Peru. While Peru's large fleets of mining machines will continue to present significant opportunity for the company's hydraulic drive business, it is in the processing plants that the company sees greater room for development in the automation area.



Nemisys, used mostly with hydraulic excavators, is our newest hammerless product and has a totally new design. All of the ESCO new product development designs are hammerless. Using a hammer in the mines is very dangerous – small pieces of steel can get into your eyes or your body, and ESCO is determined to eliminate this risk.



- Juan Parra, managing director Spanish speaking Latin America, ESCO





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Industry Explorations

Kai Rothgiesser

General Manager
BOSCH REXROTH



How can Bosch Rexroth leverage the acquisition of its local distributor in Peru?

The acquisition of our distributor, Maestranza Diesel, was a big milestone for us and, as of July 2017, we started working under a new legal entity, Bosch Rexroth SAC. Of course, the integration is taking some time, because all the collaborators are transferring from a relatively small family business to a global company. We have already strengthened our technical and sales teams in Lima, Arequipa and Trujillo. For next year, we should open service points in these locations.

In Lima, we decided to move to a new location in Callao. This is similar to what we already did in Chile in 2014; setting up a modern shop that makes a difference in front of the clients. Having a separate legal entity to the other businesses of Bosch, we are able to better implement our business model. Bosch Rexroth is business to business (B2B), whereas the other divisions of Bosch in Peru are business to customer (B2C).

What is Bosch Rexroth's current size and scope in Peru?

Today, we have 36 permanent employees and mining represents 50% of our business in

Peru. We are specialists in drives, especially hydraulic drives. We also do electric drives, where we are a strong player in automation –this is a new area that we are trying to promote in the country.

In mining, many machines arrive in Peru with the Rexroth components already installed and that requires a lot of service afterwards. We see a lot of opportunity for after-market, but also for everything related to Industry 4.0. At Bosch we have a lot of experience in these sorts of systems. By recording all the parameters of the different machines and components, you can make sure that the operation is running at an optimal level and that you can anticipate maintenance. These sensors and the wiring and software associated to them are not a big investment for the client if you compare it with the benefits you can obtain. We sell all these components, but the idea is that we also provide the service of monitoring all these parameters as well.

Within the mining food chain, which areas offer more potential?

The way we want to differentiate ourselves is with our combination of drives and automation systems. Our competitors in automa-

Tim Mitchell

VP Business Development South America **AUSTIN**



Could we start with a brief overview of Austin's rebranding?

Austin has rebranded to emphasize its global footprint. Previously, Austin was made up of many business units that have now been incorporated in a one-Austin business model. Within this, we have the JEC and Westech brands. The rebranding will make it easier for our clients and will deliver a new image for Austin, but will maintain the quality of the services and products that we provide and our focus on engineering solutions and innovation.

Can you summarize the main products that Austin can provide?

We define ourselves as the largest non-OEM manufacturer of truck body and bucket solutions in the world. That is our primary focus, although we have other products that complement that portfolio, including water tanks, service modules, underground tire handlers and others. We have two engineering offices located in Australia and the USA that tailor engineering solutions and designs for our clients. Our engineering experience dates back

to the 1960s, so we have become highly specialized. In terms of the truck bodies, we have a diverse range of products to suit coal, copper, iron ore, phosphate and many other applications. In total, since 2012, we have built more than 130 trays in Peru that are all still in operation.

What is the advantage of having a local presence in Peru?

2017 was a challenging year for new products, however we strengthened our services area through repair and maintenance of large mining components for a large miner in Peru. Our advantage is that we are the only local manufacturer of mining truck bodies of this size in Peru and being so close to our client is a great plus. Although mines opt to purchase offshore, we believe our solutions package and positioning in Peru offers our clients and the country a distinct advantage.

Could you summarize the main advantages of your JEC LD truck body?

We have taken the original JEC and Westech designs and fused them together by taking

PERU MINING 2018

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tion usually do not have the knowledge we have in the hydraulics area. In this respect, we see more possibilities in the plants than in the mobile machines, because the mobile machines are closed systems. The plants, however, include many components from different brands. The feeders and conveyors, for example, are huge investments that use a big amount of drives.

What is Bosch Rexroth's strategy for the short and medium terms?

We are in contact with the new mining projects, but it will take some time until we get the first orders. Our day-to-day business, for now, comes from the service side, and improving our service capabilities will in turn strengthen our position in front of the EPCM companies. For the next years, the growth of the organization will come from the expansion of our regional network with service centers around the country. We also see opportunities to do overhauls, which we call retrofits. These are old machines where the drives are not working properly and there we can offer a completely new system in hydraulic drives.

the best characteristics from both. There is a lot of engineering behind the steel. We have optimized the JEC LD by reducing the tray weight, which has a significant effect on the payload. Over the long run, the difference in productivity is huge and can result in production increases in the millions of tonnes.

In Peru and Colombia, the JEC LD has really taken off with deliveries in nine different mines and three different applications. For instance, it is already operating in Cerro Verde, Southern Copper, Constancia and Shougang.

Do you think the potential arrival of Liebherr to the Peruvian market may open up opportunities for Austin?

I believe Liebherr will have mining trucks in Peru within the next two years. Liebherr is currently delivering a large new fleet of trucks in Panama for First Quantum, so their footprint is growing. The Liebherr equipment is first class and we are proud to partner with Liebherr in the design and engineering of truck bodies for their machines. We are very hopeful that a mining client in Peru will give them the opportunity to enter the market here.

Raúl Ferrero

General Manager
FUNDICIÓN CHILCA (FUCSA)



How is the business doing for Fundición Chilca?

2018 is definitely an interesting year for us. Over the last quarter of 2017, the dynamics of the mining industry changed with a sustained price of copper. China reports its economy is growing at higher levels again, and China represents 50% of the world's copper demand. Also, there is the belief in disruptive technologies, particularly electric cars, which also underpins the sustained price of copper. For our industry, these dynamics are very relevant, because of the amount of equipment and aftermarket pieces needed by copper operations.

Regardless of high competition in the industry, we have grown at a fast rate sustained in our product quality and customer service. We have an expansion plan to increase the capacity of our plant by at least 50%, with some investments on smelting and machining.

What has been your strategy since you started operating five years ago?

During the downturn, the price of mill liners went down significantly. We expect that to change in the near future, but in the meantime we are focusing on other products and we are making sure that we do not compromise our quality. This is how we have secured

contracts with international OEMs and multinational mining companies. Beyond mill liners, we have specialized in manganese-based products, crushers and components for the large mining shovels.

How do you see the Peruvian market evolving, and what are the opportunities outside of Peru?

We export more than 50% of our sales. I see very good opportunities for mining all around the Americas, particularly thanks to the good prices of copper and other minerals like gold and zinc. During the down cycle, the large investment projects were put on hold, and mines squeezed their inventories. Now, with the current prices, mining companies are investing in additional inventory of parts to ensure that they do not have any stoppages. Also, they are reopening the operations that were not profitable during the downturn. Additionally, we see the large greenfield projects coming back to life, although these will take several years to translate into orders for us.

Beyond quality and price, do clients pay attention to other issues such as low carbon emissions?

Today, there is a huge focus on community relations and sustainability, pushed by the international mining companies and the OEMs. This is making its way across the supply chain. We conceived our plant to be environmentally friendly and clients can see that every time they visit our facility.

Could you summarize your main advantages?

We have state-of-the art laboratory equipment to perform all the relevant tests that the clients require. We monitor quality throughout the whole process, and that starts with the right selection of suppliers. We have developed six types of manganese alloys, 11 types of chromium-molybdenum alloys, and several types of white iron alloys. Also, mining is increasingly incorporating bigger equipment. This is why we built our foundry with a capacity to produce pieces of up to 20 tonnes. We are the only foundry in Peru that can do that.

There is opportunity in the market. Beyond our sales in Peru, we are already exporting to Chile, Colombia, Mexico and the U.S., and there is no reason why we should not export to other countries like Canada. Our focus is to continue growing in this respect, with a focus on quality products and processes.

Industry Explorations PERU MINING 2018

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Underground Equipment

Increased mechanization opens the door to new solutions

The improvement of the market has clearly been felt across the underground spectrum. Indeed, higher base metal prices have drastically improved the economics of many mines, encouraging operators to engage in more dynamic budgeting after years of severe cuts in investment. Normet, a Finnish company specialized in underground equipment, had good results in 2017, according to Franklin Pease, its general manager in Peru: "We started to see many companies

renewing their fleets, activating the investment programs they had put on hold during the crisis."

Normet is mostly known in Peru for its Alpha 20 shotcrete sprayers and its Tornado shotcrete mixers, but the company offers a wider portfolio of solutions that go hand-in-hand with the mechanization of underground mining. Peru's latest safety regulations oblige operators to mechanize certain processes, such as scaling or certain jobs at

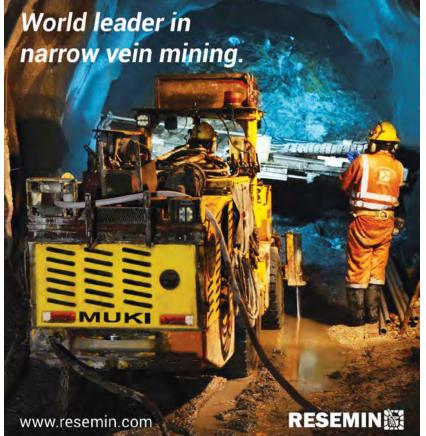
The suspended monorall offers savings in tunnel construction and 50% lower operational costs. In a mine processing 400 mt/d or more, you can reduce the return on investment period by up to two years. We estimate that one of our battery-powered locomotives can replace five 20-mt diesel trucks, with the additional advantage that we can work safely at a 40-degree inclination.

- Daniel Samaniego, regional manager, Ferrit



height, where Normet's range of equipment can be of help. Pease affirmed that innovation and mechanization have certain limitations, especially in narrow-vein operations: "When you have small tunnel sections, you do not have all the equipment you need to mechanize the operations. Narrow-vein mining is a very small percentage of the total underground mining in the world, but we need to adapt to the different needs of the market [...] Changes will happen sooner or later: as an example, most mines will mechanize the charging of the explosives, because you will reduce the amount of explosives needed."

The lack of mechanization in narrow-vein operations opened up a business niche that the very large OEMs probably did not find to be large enough for them. Yet, it is a significant market worldwide. Resemin, a Peruvian manufacturer of underground



118

120>>

INTERVIEW =



James Valenzuela

CEO and Chairman

I always felt the need to offer the complete set of underground machines. I was offering premium rigs but not the loaders. It would have been a five-year learning curve to build the line of scoops from scratch, but with our purchase of Schopf we have acquired a well established brand

and all their technology.

How has Resemin performed in 2017?

In 2016, we sold 62 machines and, in 2017, we increased production by 50% to 92 machines. This year we are expecting a 40% increase. There has been a strong pull from the market because of record metal prices in zinc and copper. We have expanded to new markets including Kazakhstan, Nicaragua, Russia and Bosnia and Herzegovina. 2017 was a fantastic year for us and I could never have expected to be in the spotlight and be named Peru's EY Entrepreneur of the Year.

Another important highlight during 2017 was the purchase of Schopf, a very well known manufacturer of underground loaders from Stuttgart, Germany. We bought the technology, the engineering and the brand, so this year we are starting the process to manufacture Schopf loaders, initially the 3.5-tonne loaders.

Where does Resemin's product fit into the current market?

We are consistently at the forefront of growth in the market. The most successful product lines at the moment are the roof bolters and the Muki. There is now greater demand for equipment for smaller tunnels, like three meters by three meters, this is why the Muki is constantly described as a game-changer. We are the market leader in narrow-vein machines and the Muki is the complete solution for that sort of environment in the fact that it has four applications: drilling, scaling, roof bolting and cut-and-fill mining. It can quadruple productivity compared to a manual drill. The Muki is reshaping the way narrow-vein mining is developing.

Is your strategy for Resemin to be a narrow-vein specialist or a full-range underground supplier?

We are competing in all sectors of underground mining with our main competitors, Atlas Copco and Sandvik. The only area where we do not compete yet is fully-computerised drilling machines, which are mainly used in civil construction. However, companies like Rio Tinto and others are starting to ask for increased electronics and computerized drills, so we already have a project to incorporate those features in the near future. Overall, the strategy for Resemin remains simplicity in design. That is our philosophy, value and mission. We have been prolific in innovation with the building of Muki and we have demonstrated this not only in narrow-vein equipment but also in the development of brand new roof bolters. We offer the smallest roof bolters in the market and we do not face any competition in this particular product.

What is the status of your plan to move into the scoop market as well?

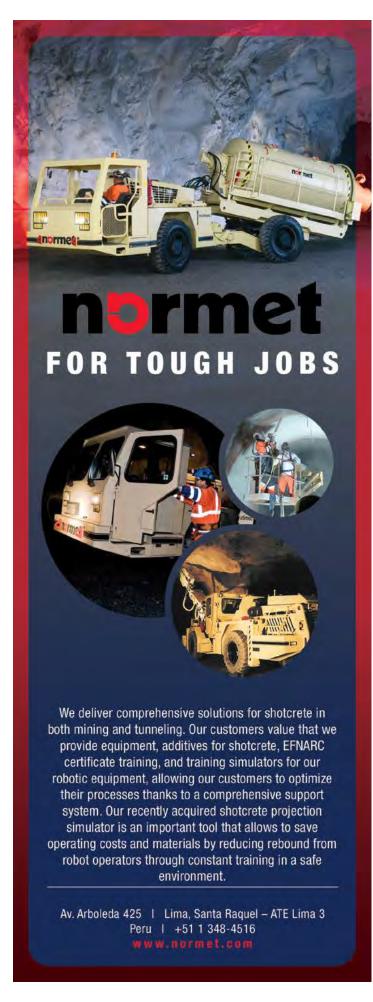
As I said above, we recently bought Schopf. I always felt the need to offer the complete set of underground machines. I was offering premium rigs but not the loaders, unlike Sandvik and Atlas Copco. It would have been a five-year learning curve to build the line of scoops from scratch, but with Schopf we have acquired a well established brand and all their technology. We now have a complete line of product and the loader market is three times the size of the market for drilling rigs. It is an enormous growth opportunity and we expect the first units to be produced in Peru this year.

With fatalities in mining increasing in Peru, what is Resemin doing in regards to safety?

A lack of training and poor roof support are causing more fatalities in mining. Safety is our top priority and always will be. The Muki is a prime example of how our technology can increase safety. Due to its four applications, it reduces the need for manual labor in narrow-vein mines, which decreases the chance of an accident occurring. Previously, narrow vein operations mostly used pneumatic hand-held drills but the Muki is fully mechanised. It replaces up to eight workers and in doing so increases safety records.

What are your main goals for 2018?

This will be a challenging but exciting year. Our goal is to manufacture 150 machines, including some of our first loaders. We are also launching brand new components for our roof bolter. We are very optimistic for 2018. ■



<< 118

equipment, has specialized in exactly this segment, and is capitalizing on its innovation efforts to achieve dramatic growth rates (50% in 2017) as the mining market picks up. Resemin produced 92 units last year and the company has expectations to reach the 150-unit/year mark soon. For this, however, the company will have to set up additional manufacturing capacity, as its 9,000-square meter plant in Lima is already working at full speed. "Our most successful product lines are the roof bolters and the Muki," related James Valenzuela, CEO and chairman of Resemin. "There is now greater demand for equipment for smaller tunnels of three meters by three meters, this is why the Muki is constantly described as a game-changer. We are the market leader in narrow-vein machines and the Muki is the complete solution for that sort of environment in the fact that it has four applications: drilling, scaling, roof bolting and cut-and-fill mining. It can quadruple productivity compared to a manual drill."

Another important milestone for Resemin's corporate growth was its purchase of Schopf, a Stuttgart-based manufacturer of underground loaders. With this acquisition Resemin received all the technology and engineering capability of Schopf as well as the brand, and now the company will begin manufacturing Schopf loaders in Peru, initially the 3.5-mt payload model and will progressively move up the product range to the 18-mt payload loaders. Valenzuela emphasized that now Resemin has the full offering: "We have a complete line of products for underground mining, and the loader market is three times the size of the market for drilling rigs. It is an enormous growth opportunity for us."

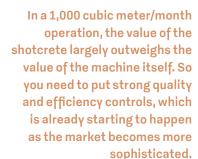
Beyond Resemin and the large Nordic players in underground equipment (Epiroc, Sandvik) there is Ferrit, a manufacturer from the Czech Republic. While the company offers locomotives, utility vehicles and crawler-mounted equipment, it is with the suspended monorail track that it is trying to break ground in the Peruvian underground market. "With this technology, you can transport ore, personnel or cargo using the same locomotive. These systems can work with inclinations of up to 40 degrees, and are already in operation in Mexico in a polymetallic mine, and in Colombia in a coal mine. In this particular case, we have additional flame-proof protection for the locomotive," explained Daniel Samaniego, regional manager of Ferrit for Peru, Ecuador and Bolivia.

Samaniego added that the systems are suitable for both open pit and underground mines: "We have received enquiries from some of the large open pit copper operations that have conveyor belts going through inclinations of 20 or 30 degrees and in areas with no vehicle access that maintenance personnel can only reach by foot."



Franklin Pease

General Manager
NORMET



What main trends have you seen in Peru's underground mining over the last few years?

While 2016 was not a good year for us, as most opportunities did not come to fruition for several reasons, in 2017 we felt a reactivation in the market with better mineral prices. We started to see many companies renewing their fleets and activating the investment programs they had put on hold during the crisis. Thanks to this, 2017 was a good year for Normet, with significant sales of new equipment. Our main products continue to be the shotcrete sprayers, namely the Alpha 20, and the mixers, with our Tornado line.

Also, we have been working on other business areas for several years. These are related to the mechanization of processes in underground mining, thanks to the clients' initiatives and also to the impulse of the new safety regulations in Peru. The new rules now require for certain tasks, like the scaling process or certain jobs at height, to be mechanized, and we have a number of platforms with different configurations for those needs.

How do technology companies like Normet help miners increase efficiency?

In the long run, the mine needs a good margin between the production cost and the value of the mineral. If the mine is not efficient, it does not generate cash, so we want to help customers in this respect. This requires constantly improving the processes, and in underground mining companies this can take a bit longer to change than in open-pit mining. There are more limitations in underground mining: for instance, when you have small tunnel sections, you do not have all the equipment you need to mechanize the operations. But changes do happen sooner or later: as an example, most mines will mechanize the charging of the explosives, because you will reduce the amount of explosives needed.

What is the role that the operators play in improving productivity and reducing costs?

Mining companies and contractors should dedicate strong efforts to the shotcrete mixing process, because the value of the mix is very high. In a 1,000 cubic meter/month operation, the value of the shotcrete largely outweighs the value of the machine itself. So you need to put strong quality and efficiency controls, which is already starting to happen as the market becomes more sophisticated. This is also strongly linked to the selection processes of mining operators: it is absolutely key to hire the best people. At Normet Peru, we invested in a simulator a few years ago that shows the skill level of our employees before they are sent to the mines.

What are the limitations of shotcrete ground support for narrow vein operations?

The shotcrete technology has some limitations. Yes, it could go into tunnels of three-by-three meters, but going to smaller sections is going to be a real challenge because the shotcrete application requires a distance from the wall of between 1.50 and two meters. At the end of the day, narrow-vein mining is a very small percentage of the total underground mining in the world, but we need to adapt to the different needs of the market.

Beyond equipment sales, how are the other businesses of Normet doing in Peru?

The sales of chemicals for shotcrete production have increased significantly for us. With regard to the dynamic bolts, we keep presenting them to the market and we are also seeing interesting opportunities in the pre-injection and post-injection methods, which are used mostly in civil works and less so in mining. We are waiting to see the reactivation of the big infrastructure projects in Peru, which have been delayed due to the political situation, but which would present great opportunities for us. As of today, most of our business comes from mining.



What areas is Normet's R&D department working on?

We continue working to improve fuel consumption, the efficiency of the hydraulic systems and of course, to enhance the safety aspects and the ergonomics. It is very important that the machine adapts very well to the operator and allows for the best visibility. This increases both safety and productivity. Normet's R&D department is also working on the development of battery-powered equipment following the latest trends of the market. \blacksquare

Industry Explorations

INTERVIEW Global Business Reports

Exploration Technologies and Consumables

Guillermo Weston

General Manager **BOYLES BROS DIAMANTINA**



Could you provide an overview of Boyles Bros Diamantina?

Boyles Bros Diamantina is a company dedicated to the fabrication of bits, accessories and piping for mining exploration. Our Peruvian plant is specialized in diamond bits and accessories, while the Chilean unit is more specialized in drill pipe. We have a fabrication capacity of 5,000 bits per month. We reached those figures during the peak of the cycle, but today we are working at around 50% of that. We are riding the wave of growth in Peru, but we want to continue expanding our international sales as well.

What are the main factors to be considered when choosing the right drill bit?

We have the Up series, which covers the whole spectrum in exploration drilling and last year, we launched the New Generation (NG) series. Clients look at two factors: speed of drilling and bit durability. If you use a harder bit, the drilling process is slower, but if you need to replace the bit after 1,000 meters of drilling, that may take six hours. In this business unproductive times have to be reduced to the minimum because contractors are paid per meter drilled, regardless of how long that takes.

Alfredo Huldisch

General Manager
CORE TECH



What is the importance of innovation and technology in the exploration industry?

Innovation is one of our core values. Over the years, we have introduced solutions to avoid water from being in touch with the core sample, so we have developed different types of bits adapted to that. We have also developed our own line of drilling fluids, and have other related products like greases, dispensers, bentonite, and polymers to prevent water leaks or to make sure the hole will not collapse. We also have a technology to monitor the deviation of the hole, because a tiny deviation in the process can lead to the wrong results.

What is your strategy to mitigate the volatility of the exploration segment?

There are many competitors in the different business segments that we cover, but it is not easy to find companies that can provide the whole solution for exploration activities. Our strategy is that, now that we have completed our range of solutions for greenfield exploration, we are moving towards brownfield activities in mining companies that are already in production where exploration never stops. This way we can better overcome the cycles, because exploration is too volatile.

Adriana Orihuela

Country Manager
TECHNOSTEEL



What are Technosteel's main brands and business lines?

Our first brand is Technosteel, which manufactures drilling rods and distributes tricones and shock absorbers for both rotary drilling as well as equipment for fluid artificial lift or pumping systems. Our second business line is Safedrill, that develops and manufactures rod handlers for drilling that are 100% hands free. Our third brand is Polimet, which is focused mainly on conveyor solutions: from the engineering design to the manufacturing of our own idlers, pulleys and frames which can provide savings in energy consumption as well as a longer component life.

How is the SafeDrill rod handler different from other models in the market?

Our rod handler was conceived out of the necessity to have a 100% hands-free rod handler with added value. Our offer provides not only the handler itself but includes a rod rack that can load up to 2,000 meters of drill rods, as well as a mud treatment plant and a refuge cabin. This way, you are not only increasing safety for workers but also increasing productivity, optimizing water recovery at the mud treatment plant and keeping your workers safe in case of a storm.

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PERU MINING 2018

Comminution and Material Handling

Companies involved in the technology for mineral handling and processing facilities are also gearing up towards the new wave of projects, as well as the service and maintenance contracts associated to an increasing installed capacity. Last year, for instance, 65% of Metso's sales in the Pacific Rim region came from services. Equally, FLSmidth has increased its team for the Customer Service business line, which is not an easy process for OEMs, said Jesús Cabrera, general manager of FLSmidth: "Providing maintenance and repair services is more challenging because it requires a larger headcount to work on projects such as plant shutdowns. You need people who have certain skills and a safety culture."

The advantage of having a stronger team of people is that this can also provide synergies to offer additional services. As an example, FLSmidth has been increasingly implementing the EPC concept, with

five of these projects already completed in Peru, explained Cabrera: "At Antapaccay, we did the EPC for the expansion of their flotation capacity, with the largest flotation cells available worldwide. It was a very successful project."

Large OEMs are also starting to offer mining and material handling solutions that could forego the need for mining trucks. Thyssenkrupp Industrial Solutions, for instance, is looking at introducing continuous mining systems in the country. Miki Villar, business development and sales manager at Thyssenkrupp, explained that this technology is most suitable in mines that have distances of more than five km between the mine and the plant, and hauling volumes of at least 50,000 mt/d. So far, Thyssenkrupp's star product in Peru is the high pressure grinding roll (HPGR), of which there are 21 operating in Peru -that is more than in any other country where the company operates. 127>>

One of our main innovations over the last years was the CleanScrape solution, which was developed in Germany. It is a more efficient conveyor belt cleaner and with larger wear life that does not require any servicing or adjustment until the end of its life. Beyond productivity, this minimizes the exposure of technicians to the risks presented by large equipment.

- Javier Schmal, managing director Latin America, Martin Engineering







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WE DISCOVER POTENTIAL

If you have a fleet of 150 mining trucks, each one of them needs at least three drivers and the maintenance team – probably 600 people in total. If you want to go for a conveyor belt method, probably all you need is five people. The capex for this can be considerably higher, but the opex is drastically reduced.

How has FLSmidth continued to consolidate its position in Peru?

We started FLSmidth in Peru in 2008 with six people. Today we have a payroll of 350 people, plus we have many more collaborators for the different projects. We have four business units worldwide and in Peru: Cement, Minerals, Customer Service and Product Companies, which includes nine brands. In Peru, we have been implementing our strategy in the different areas, mostly in Minerals and Customer Service, where we do not only do spare parts but also provide maintenance and repair services. This is more challenging because it requires a larger headcount to work on projects such as plant shutdowns. You need people who have certain skills and a safety culture.

In Minerals, which is related to capital investment, we have increasingly been implementing the EPC concept. As part of that, we do engineering, we move earth, we sell equipment, we install it and we connect it to the existing plant, and we also do the commissioning and ramp-up. We have already done five EPC projects in Peru with very decent results. Of course there is a limit for this, as we cannot handle very large projects under this model, but for these expansions we are trying to take that expertise to other countries in the region. Finally, in Product Companies, we have had a lot of success with Krebs, a leading player in separation with cyclones and pumps.

What areas do you see more opportunity for in Peru?

Quellaveco is probably the largest greenfield project coming up. All the others in the pipeline are smaller. We are more comfortable in the multi-billion dollar project range, because of the size of our equipment. We are leaders in the grinding area, with the crushers and the mills, but we are also very strong in the process area, with flotation cells, thickeners and filters. We have a large installed capacity of flotation cells in Antapaccay, Las Bambas, Cerro Verde and Toquepala. At Antapaccay, we actually did the EPC project for the expansion of their flotation capacity, with the largest flotation cells available worldwide. It was a very successful project.

How is mining evolving in regards to tailings management?

Recovering all the water that you took from the earth is the future of mining. That means having a mine with no tailings dams. While many mining operators still see these solutions as being too expensive, the new regulations and the demands from the local communities will increasingly push companies to go in this direction. At FLSmidth we have the full solution for this, from the filters and thickeners to all the technologies for material handling.

In the debate of capex vs opex, what benefits can conveyor belts bring to the table?

If you have a fleet of 150 mining trucks, each one of them needs at least three drivers, and then all the related team to do the maintenance for the tyres, the engines and other components. In total, you probably need a team of 600 people. However, if you want to go for an alternative conveyor belt method, probably all you need is five people. The capex for this can be considerably higher, depending on the topography of the terrain, but the opex is drastically reduced.

Considering the current market developments, what are your expectations for 2018?

We really think we have a good opportunity with Quellaveco. We also hope that the Tía María project will be built, as it has FLSmidth equipment waiting to be installed. We have good opportunities as well with a couple of big projects in Colombia and Brazil, and in Chile we are starting to install equipment for Quebrada Blanca and Spence. In Peru, since last October, we have been reviewing our organizational chart, including our shop in Arequipa, to become more efficient. For this year, we will continue with the expansions and debottlenecking projects while we become stronger in customer service and maintenance. We think that we will see higher levels of growth in 2018 as compared to 2017, but as part of that, Peru should overcome the political instability; this country deserves a better political situation and it needs to solve all the compliance issues that we are facing today.

PERU MINING 2018



Fernando Samanez

VP Sales Mineral Processing Solutions - Pacific Rim

METSO

44

The new cycle has already started.
The markets are asking for more copper production. Demand coming out of electric cars is huge, we probably will need ten more Quellavecos around the world to meet that. However, mining companies are way more cautious.



How is Metso adapting to new market trends?

The main development for Metso lately is our strategy to standardize our product line. Before, we were mostly an engineering company that would design the equipment for the particular needs of the clients. Now, we are migrating toward the sale of standard equipment, which is easier for both parties. It is very similar to what Caterpillar or Komatsu already do; they have standard models. Probably 20% of our sales today are standard equipment and we are willing to increase that figure to 50% over the next couple of years.

How do you work in collaboration with your different plants and offices?

We have the process equipment office in Sweden, our main comminution office is in Pennsylvania, and our bulk material handling office is in Brazil. We have our own manufacturing facility for rubber wear liners in Peru, and we also have a factory in Chile. The integration of these two plants gives us an advantage in terms of delivery times. In manganese products we have local foundries competing with us, and Brazil is not competitive nowadays, so we are utilizing our Chinese factory to produce those liners.

What is your view on the different mining cycles?

The new cycle has already started. The markets are asking for more copper production. Demand coming out of electric cars is huge, we probably will need ten more Quellavecos around the world to meet that. However, mining companies are way more cautious. They have more stages for the approval of projects, and some companies want to have 70% of the detailed engineering before taking the final decision, like Marcobre. So, the milestones are different.

Could you provide a summary of your main product lines?

Today, we have 75% of the equipment needed in the mining value chain, starting with primary, secondary and tertiary crushing, as well as all the grinding equipment (SAG mills, ball mills, autogenous mills, pebble mills, tumbling mills and vertical

mills for tertiary grinding); also, we are gaining ground in flotation cells. We have recently won three important projects for flotation cells; in Portugal, Turkey and one in Peru for the expansion of Toromocho, with 300 cubic-meter cells. We also have the filters for the concentrate.

In comminution (crushing and grinding) we are the largest player in the world. Now, we want to push for the flotation areas and material handling. Metso is the largest supplier of conveyor belts in Brazil, so we have very good technology. We won a project in Chile for Chuquicamata Underground, and we are offering that in Quellaveco as well.

What are the main developments in Metso's R&D?

We have introduced the hydraulic roll crusher (HRC), which is the competitor of the HPGR. Our HRCs are the largest in the world and they have already worked in Freeport's Morenci mine for more than three years. Each of the HRCs can produce more than 80,000 mt/d, so it is three times more than the HPGRs offered by the competition. We also have sizers going into the market, and we are going to start manufacturing 600 cubic meter flotation cells as well

Moreover, we have a new simulator, the VPS (Virtual Plant Simulator), and finally we are introducing a new crusher, the MX, that combines the two technologies that have existed in the market for 100 years: the hydraulic cone technology and the fixed shaft technology. In water management, we are investing in new technologies to filter the tailings. A prototype is going to be ready in Sweden by the end of 2018. It is based on our current technology, but applying 10 times more pressure. Water recovery is the future of mining.

What are the prospects for Metso in Peru this year?

Our idea is to be close to our customers: 65% of our sales in the Pacific Rim region come from services. In Peru, we have a big after-market division with more than 230 people in services. This year we should focus on specialized services and reach 10% growth in this area, while along the way we will also have around 60 to 80 million euros in capital equipment sales.

Mijail (Miki) Villar

Business Development and
Sales Manager
THYSSENKRUPP INDUSTRIAL
SOLUTIONS



Can you tell us about Thyssenkrupp's business divisions for mining?

In Thyssenkrupp Industrial Solutions' mining portfolio there are three distinctive areas. The first is the production of equipment for continuous mining systems, offering state of the art alternatives to trucks and shovels. These include the bucket wheel excavators, and a number of conveyor systems to transport both soft and hard rock minerals to the plant. This is an area of the business where we see great potential for growth.

The second area of interest is the processing of minerals, where we utilize a combination of crushing and grinding technologies – we have more HPGRs installed in Peru than in any other country in the world. Our third area of interest is related to material handling, mostly for concentrate stockyards and shipping.

In what environments do continuous mining systems and HPGRs apply best?

The most suitable mining environment for a continuous mining system is a mine where the transportation distances from the mine to the plant are 5 km or more, and when the load being transported is 2,000 mt/h or more. So, any mine handling at least 50,000 mt/d, between

the mineralized material and the waste, could benefit from a continuous mining system.

Thyssenkrupp's HPGR technology works well to break down copper and iron hard rock combinations. One of the key advantages of this particular technology is that it creates microcrevices, and these make the grinding and crushing process more efficient, which adds to lower energy consumption. Thyssenkrupp's machines are able to process a lot more efficiently than standard crushers. We have 21 HP-GRs in mines all over Peru.

Is there a trend towards the standardization of mining equipment?

The industry moved a long time ago from very standardized models to highly tailor-made machines in the 1990s. However, we are now seeing the trend of the industry shifting towards the implementation of more standardized machines. This is driven by the experiences of the largest mining projects during the high cycle. Projects that started with a certain budget often ended up having huge cost overruns and significant project execution delays because of the excessive customization of the equipment. Standardized machines give the benefit of faster delivery times and lower-cost engineering.

Karina Zevallos

Managing Director
WEIR MINERALS



How are you expanding your portfolio?

Weir's traditional product line is pumps: process pumps and mill circuit pumps. However, we have a very wide range of products including comminution equipment, classification technologies, piping and valves. Our main acquisition over the last years was Trio, which opened up our portfolio to the dry side of the process. Weir Minerals is also in the process of acquiring ESCO, to add mining equipment to our portfolio.

What synergies were created with the Trio acquisition in particular?

Trio was already a well-known brand, and I would like to think that it is even better known today. From Weir we have implemented our own quality control procedures and safety standards, and we have also given Trio a more global capability for distribution and manufacturing, thanks to Weir's client network and global footprint.

Are you following, like other manufacturers, the strategy to standardize equipment?

Our solutions are tailor-made. Of course, we have some standard products, like valves and pumps, but those products will not suit everybody. Standardizing our products would suit

our performance internally – yet we are not meant to focus on that, we should focus on our customers. We consider ourselves as solution providers. Depending on the clients' needs (volume, space, energy consumption) we develop the right solution for them.

Who are your main customers right now, and what are the main drivers?

Our biggest packages lately have been for Southern Copper's expansions, mainly with pumps and valves. Then, on a regular basis, we provide supplies and spare parts to all our customers. Our business is divided in three components: capex (original equipment), after market (for the equipment in operation) and services. Right now services represent 3% to 5% of our sales, because our business model often means that we do not charge for the services

In 2018 we are focusing our efforts on all the components of the mining process: spools, piping, valves, rubber linings and others. Besides, we are also putting emphasis on efficiency in terms of energy usage, water recovery, mineral recovery, and tailings. Finally, we have a wide market to penetrate in comminution, not only with the new greenfield projects, but also in the existing mining operations.

PERU MINING 2018 Industry Explorations

<< 123

Water Management

The main technology companies are highly involved in solutions to increase water recovery, and they actually envision future mines that will have no tailings dams: "While many mining operators still see these solutions as being too expensive, the new regulations and the demands from the local communities will increasingly push companies to go in this direction," assured Cabrera of FLSmidth.

Metso is also investing in new technologies to filter tailings, with a new prototype being developed in Sweden this year. "It is based on our current technology, but applying 10 times more pressure," said Samanez, who added: "Water recovery is the future of mining."

Water separation is an increasingly important business for Andritz, a multinational company that has been expanding its installed capacity of thickeners, filters and water treatment plants in Peru. As an example, Andritz is installing the largest filter press ever built by the company globally (140 plates of 2.5 x 2.5 meters each) at Buenaventura's Tambomayo mine.

Andritz is also reinforcing its service capability by opening up a local shop in Peru, avoiding import delays for products. "Peru's mining industry only discovered the quality of our products relatively recently, so there is a lot of room for growth," declared Peter Gnos, general manager of Andritz.

Everaldo Abegg, country manager for Andritz' separation business, added: "We have recently invested US\$5 million in our filter cloth production line in Brazil, and with this investment we are ready to serve the whole South American market. We already have some thickeners in operation in Tambomayo, and also 14 water treatment machines in Cerro Verde. Overall, in the separation business, mining represents 85% of our revenue."

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What is Andritz' track record in Peru?

PG: Andritz has a really long history in the country, starting with the energy business. The first turbine was sold in 1913, but the company had a different name back then. After many acquisitions, we are working under the Andritz name since 2010, on both energy and separation. We are basically a sales organization, and in energy projects we also provide the support to the execution, with local transport and plant installation services. We do not have production capabilities in Peru, but we are providing services supporting the sales of new equipment and doing repairs and overhauls. A growing market for us today is operations and maintenance in the energy business.

We currently have 23 employees: 14 in the hydro business and nine people in separation. We also have another 40 people onsite, because we are doing the rehabilitation of the Callahuanca plant near Lima for Enel. In the energy business, we have Andritz equipment in the second largest hydropower station in the country, Cerro del Águila. We also built the Santa Teresa plant.

Who are your main mining clients?

EA: Our strongest mining client in Peru is Buenaventura, and we also work with Poderosa. In Buenaventura we have started the assembly of the largest filter press ever built by Andritz globally (2.5 meters by 2.5 meters per plate, with 140 plates). This was built in Brazil for the Tambomayo mine, and the filter will be operational between May and July 2018. Meanwhile, we also provide equipment for Nexa at the Cajamarquilla refinery, where we have three projects ongoing.

Where do you have your main manufacturing plants for separation technologies?

EA: Depending on the technologies, we have manufacturing plants in different locations around the world. In Brazil, for instance, we have recently invested US\$5 million in our filter cloth production line. We produce all types of cloths for our filters as well as for other brands, and with

this investment we are ready to serve the whole South American market. We are also starting to offer our thickeners locally, a business line that is headquartered in South Africa. We have some thickeners in Tambomayo and we are in negotiations with Poderosa to sell this technology. In Chile and Brazil we also have thickeners in operation with customers such as Codelco, Vale and Imerys. Finally, we have solutions in water treatment for mining too; for instance, we have 14 machines operating in Cerro Verde. Overall, in the separation business, mining represents 85% of our revenue.

What are the prospects to further expand the business in Peru?

PG: Peru is one of the countries that offer great potential for growth, both for the separation and the energy businesses. In separation, we are opening a local shop so that we can stock products in Peru and give a faster response to our clients. Peru's mining industry only discovered the quality of our products relatively recently, so there is a lot of room for growth. In the energy business, Peru offers several large hydro projects that are feasible and that will be built over the next years, whereas other countries are stuck in their energy infrastructure development. Perhaps growth rates in Peru are not explosive, but we can build the company in a sustainable way. EA: In separation, last year we had revenues of US\$17 million. Of that, US\$11 million came from after-sales and spares, while US\$6 million came from the sale of new equipment. For this year, our goal is to have revenues of US\$30 million, and the start of 2018 has already been very good. We want to have a bigger portion of sales coming from new equipment. We want to grow aggressively in the filter cloth segment, where we have a 17% market share, so there is plenty of room for growth. By the end of this year, we want to have a 25% market share in filter cloths. We are constantly improving our cloths for better performance and, having a stock of products locally, we will no longer be affected by import delays. We are in a great position to serve the local clients.

128

PERU MINING 2018 Industry Explorations

Productivity Technologies and Automation

Penetration rates are still low in Peru, but the trend towards digitalization will continue

Low labor costs are a double-edge sword: while mining companies have access to operators and technicians at significantly lower costs than in other mining countries. this acts as a disincentive to introduce new technologies that will make the operation more efficient. Certainly, there is a corporate responsibility aspect whereby the industry should provide as much employment as it can, but there are other factors to be considered such as efficiency, which will ensure the sustainability of the business in the long run, and safety, including aspects like the mechanization of underground mines and the introduction of digital systems to prevent accidents.

Beyond the cultural barriers towards the introduction of new technologies, there are regulatory obstacles as well, said Takaaki Kitabayashi, CEO of Komatsu-Mitsui Maquinarias: "Chile, Australia and Canada already made some adjustments to their framework to allow for the operation of autonomous trucks in aspects such as safety, communications, insurance requirements and others. In Peru, we still need the legislation to evolve a bit."

Presented with a variety of options and solutions, mining companies and their EPCM contractors may have a different view of how they want to build and run their operation. According to Franco Bulnes, country manager of Eaton: "The end user always wants more performance, more reliability, more safety, whereas the EPCM contractor may favor the easier solution to install and implement."

The advantage of digitalization is that it allows engineers to recreate the real conditions of the mine in advance, providing for better insights into what the best solution would be. Siemens, for instance, can create a 'Digital Twin', that basically simulates the whole operation. "With *Digital Twin*, you can anticipate any potential problems before you start operating, and then you can use remote technologies to run the operation. At the same time, you have a lot of data to analyze. Here is when big data turns into smart data," said Christian Candela, CEO of Siemens' Energy Management division in Peru.

In this scenario, the manufacturers of equipment are increasingly migrating towards a different business model, said José Quiñones, general manager of Yokogawa Peru: "Moving forward, all the information is going to be taken wirelessly to the cloud, and our business is going to migrate towards the consultancy model. Hardware will be just a tool for managers to run the plant more efficiently."

The mining industry is still not willing to move very fast towards digitalization and totally remote operations. While some providers offer an integrated software solution to manage the plant processes remotely, our focus is on the Internet of Things, connecting all our devices, even by smartphones, with many communication protocols to ensure the best compatibility.

- Franco Bulnes, countrγ manager, Eaton





What is Siemens' participation in the mining industry?

Siemens' core business in mining is focused on the areas of electrification, automation and digitalization. These are present across the whole value chain, from the initial excavation to concentrate or cathode production. We provide the entire electrical infrastructure for the large equipment units to work with mobile substations that are located within the pits. We also provide all the electrification for the conveyor belts. We have the engines that drive the mills and we can also support electrification and automation of the chemical production process. Unlike in the power segment, where energy is the business in itself, in the mining industry energy is something operators need to produce the mineral. We can provide all the support they need, from start to finish.

How important is R&D for Siemens?

Our founder, Werner von Siemens, started the company 160 years ago inventing a new type of telegraph. Today, ingenuity is in our DNA as we invest more than 5% of our revenue in research and development. Beyond the day-to-day improvements of the different products, we are also highly focused on Industry

4.0 and digitalization. Before an operation starts, we can create what we call a 'Digital Twin' that recreates the whole operation. Additionally, we are working on energy efficiency solutions, as power consumption represents between 20% and 30% of the production cost of copper. We have solutions that provide energy savings of between 10% and 40%.

How is digitalization going to change mining operations?

Digitalization is not the future, it is the present. Digitalization tools are expected to be integrated at all mining stages, from exploration, engineering and simulation to advance process control. Our main challenge is to identify and understand how we can have an impact by implementing digitalization, with energy savings, less plant shutdowns, fewer trips to the mine and higher levels of safety. With solutions like Digital Twin, for example, you can anticipate any potential problems before you start operating, and you can use remote technologies to run the operation, but at the same time, you have a lot of data to analyze. Here is when big data turns into smart data, a new challenge to face with digitalization. ■

José Quiñones

General Manager
YOKOGAWA PERU



What is the background of Yokogawa in Peru and its mining industry?

Yokogawa is a Japanese company with a history spanning more than 100 years. The company has three main business lines: automation, instrumentation and controls, and avionics. Our main lines globally are automation and instrumentation for the processing industry – mining, oil and gas, petrochemicals and food and beverage. With our instrumentation we have all the measurements for different variables. Meanwhile, the automation solutions control all the processes in the plant.

In mining, we installed an automation system for Minsur's tin refinery in Pisco that has been in operation successfully for 20 years. In the processing industry, it is very important to prevent production stoppages, because shutdown costs are very high. Ideally, if you need to include modifications or improvements, you should be able to do that online, without stopping the operation. In mining, beyond our participation with Minsur, we are not very strong in automation. However, in instrumentation and controls, we are present in probably 70% of the mining operations in the country, at all levels.

What recent innovations are you introducing to your mining clients?

7% to 8% of our revenue is dedicated to R&D, because automation technologies evolve very fast. One of our main features is reliability: having a conveyor belt failure is critical, for instance. Toromocho had to stop one conveyor belt for 100 days because of a small fire. To avoid this, Yokogawa has a conveyor belt monitoring solution that measures the temperature of the rollers every three minutes. In a 2-km conveyor belt, you are talking of 6,000 rollers. We are starting to implement this technology in a mine in Chile.

How is IoT transforming operations?

Last year, Yokogawa acquired a company for the application of the Internet of Things (IoT). Moving forward, all the information is going to be taken wirelessly to the cloud. With this, you need the artificial intelligence to run the different models and optimize the plant. Google already does this with the information it has about its users. With all this information, our business is going to migrate towards the consultancy model. Hardware will be just a tool for managers to run the plant more efficiently.

130

PERU MINING 2018



Marcos Wieland

General Manager
SITECH

How was Sitech created in Peru?

Soluciones Sitech Perú was created five years ago to channel the joint value proposition developed by Caterpillar and Trimble. The company provides solutions and value based on the data generated by technologies in the construction and mining operations. The business is starting to take off, and the

plan for the next 10 years may take us to other sectors as well.

Could you explain about the main solutions you offer?

One of the critical factors is the penetration rate of the technology. One key focus for us is anything related to machine control and positioning on site, and the adoption rate for this is quite low in Peru if compared to North America or Australia. Because of this, we have added new lines to our portfolio to find new business opportunities, and our focus right now is more on mining than on construction.

With Trimble we have a solution that is specifically suited to roads and tailings dam construction, where you are putting layers of material and you need to monitor the thickness and characteristics. Traditionally, this is done in a rudimentary way with surveyors taking measurements here and there. With our solution, you have a high-precision GPS at the tip of the excavator, and this increases productivity dramatically. Our main competitor is the old way of doing things, and more so in Peru, with its low labor costs.

How have you expanded your portfolio for mining?

In open pit mining, we offer Cat's DSS solution (Driver Safety System), a fatigue monitoring solution based on the tracking of the operator's facial fatigue behavior through a smart algorithm. In both surface and underground mining we also have weighting and productivity solutions for loaders, excavators and conveyor belts from Trimble Loadrite, a New Zealand company. In surface mi-

ning we work with a British provider called Brigade Electronics for proximity detection and anti-collision systems.

In the underground space our solution by MST, an Australian company, enables to track where every single worker is at any time. For that, you need the infrastructure in the mine to detect tags that workers and machines are bearing. It is very successful in pretty sizeable mines, where the only method they have to know how many people are inside the mine is counting the helmets missing at the entrance. This solution can be used in conjunction with the anti-collision systems for the machines, and also with productivity solutions.

Who are your main clients in Peru, and how do you see the future of Sitech in mining?

We work with Yanacocha and Cerro Verde in fatigue detection; on the other hand, we have sold our solution for asset management (RPMs AMT) to Antapaccay and Hudbay, and we are working in underground solutions with our MST line at Buenaventura and Yanacocha.

The opportunity for us is to be a technology integrator and provide more comprehensive solutions based on information and knowledge. For instance, once you know where all the machines and all the workers are underground, you can save costs through ondemand ventilation. If you do not have anyone in an area of the mine, why would you spend on ventilation there? We are highly focused on underground mining because the penetration rate of technology is really low and we have plenty of space to grow.







Rates per meter should increase soon due to the new market dynamics

During the hard times, providers' margins were pushed to the limits. The price wars among competing suppliers, desperate to keep their contracts, allowed mining companies to stay competitive, but the urge to save costs also created other problems related to quality and service. Fortunately enough, the industry is now producing minerals at a comfortable price range and increased profitability. While that should not translate into

cost overruns, the relationship between miners and providers should be one of mutual benefit that looks at long-term sustainability for both parties.

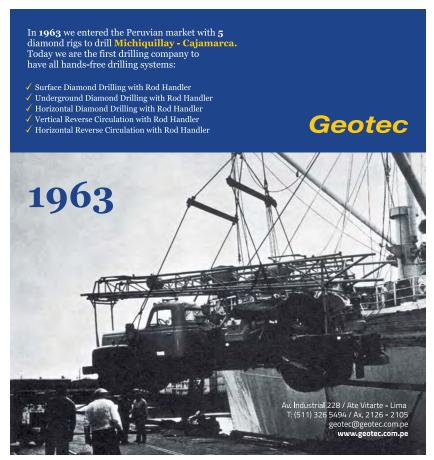
Exploration was probably the segment that suffered the most. Jorge Granda, general manager of AK Drilling International, a contractor with a fleet of 25 machines in Peru and operations in seven countries, explained that the low volume of work avail-

able and high pressure on drilling rates made the downturn a difficult period to adapt to: "During the crisis, the procurement specialists within the mining companies were empowered to take many decisions about which contractors to use. Seeing the drilling service as a commodity means that you will only pay attention to the final price, and this is shooting yourself in the foot."

Geotec, another drilling contractor, has seen a positive trend in the market and doubled its sales in 2017. Recent drilling campaigns by the larger mining operators are prompting contractors to invest in automation and new technologies related to safety. Geotec's general manager, Miguel Ángel Arenas, said: "We increasingly see clients ready to pay more for safety and new technology. In Las Bambas, we incorporated seven handsfree rod handlers, so the whole drilling campaign was hands-free. This year we won a contract to introduce intelligent machines for rod handling in underground mining. It is the first hands-free diamond drilling campaign for underground mining in Peru."

Arenas highlighted that some mining companies are willing to engage in long-term drilling contracts, like the three-year assignment Geotec has at Yanacocha, because they know the drilling rates will increase very soon. Belisario Tijero, general manager of Explomin, another large contractor, agreed: "The price per meter drilled has already gone up, that is why the clients that have signed long-term contracts have done a very good business. From our perspective, working with long-term clients reduces the risk, and we can offer a wider range of services, such as horizontal or directional drilling."

In terms of new technologies, Arenas of Geotec explained about the investment re-



104

PERU MINING 2018 Industry Explorations

quired to incorporate the hands-free rod handlers: "If you include the training required, a hands-free rod handler for a surface drilling rig can cost US\$450,000, while a brand-new drilling machine costs US\$600,000. Not all clients are willing to pay substantially more for their drilling, but for us, this amount needs to be seen as a long-term investment where we are also improving productivity, efficiency, and safety."

Granda of AK Drilling affirmed that the introduction of these new technologies, however, should not be seen as a 'one-size-fits-all': "At AK Drilling we were one of the first contractors to use these technologies for an oil and gas project in Colombia. In the oil and gas industry, you spend months on the platform and each pipe weighs half a tonne. In mining exploration, the rods weigh 35 kilograms, and you are on a platform for just a couple of weeks. In mining, you need an agile setup and competitive costs [...] At the end of the day, it is the end user who needs to decide what is best for each particular project."

People Shortages

Increasing safety standards and demands from clients with regard to particular technologies are not the only factors potentially driving drill rates up. Because drilling is a very specialized service, dealing with a shortage of drillers and helpers is a common headache for drilling contractors during the high cycles, and training proactively is a must, to anticipate future human resources needs. In this respect, Tijero of Explomin gave more details about the company's recently established drilling school: "We started our school in the south of Peru last year, with a first group of 15 trainees. This year we are planning to start our training in the Pasco area, with a focus on the drilling helpers. It is very important to be able to react during the peak moments. Last year, at some point, we had 1,200 workers."

"The main issue is training personnel," agreed Arenas. "Due to our current demand, 40% of our employees are hired externally leading to increased training hours. We are constantly training our employees in Peru and abroad; for example, we send our people to train with Halliburton in Houston. A substantial part of our team have been with Geotec for many years so we must be doing something right."



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Jorge Granda

General Manager

AK DRILLING INTERNATIONAL

I have never understood that large mining companies with solid financial capacity wait until the prices are high to carry out their exploration campaigns. Of course, mining organizations have their own financial reasons, but strategically speaking, you should do that when prices are low, when

you can get the best drilling rates.

What is AK Drilling's positioning now that we are leaving the long exploration crisis behind?

With the crisis, many competing companies paid more attention to their P&Ls than to their drilling. We downsized and focused on keeping our quality service, which gave us good results. We also restructured and reduced our debt as much as possible. As a result, at the start of 2018, we had a much better position, both in terms of our operational capacity and our financials.

A positive development is that the clients have realized that price cannot be the only driver. You can adjust your costs up to a certain limit, but you cannot really let that affect your workers because this is a specialized service, and quality ends up worsening. Many clients have come back to us after a bad experience with other contractors. What happened during the crisis is that the procurement specialists within the mining companies were empowered to take many decisions about which contractors to use. This always happens during the low cycles. Seeing the drilling service as a commodity means that you will only pay attention to the final price, and this is shooting yourself in the foot.

Are mining companies trying to secure long-term contracts now that drilling rates are expected to increase?

I have never understood that large mining companies with solid financial capacity wait until the prices are high to carry out their exploration campaigns. They should do that when prices are low, when you can get the best drilling rates. Of course, mining organizations have their own financial reasons, but strategically speaking, you should do things the opposite way. Today, mining companies continue with their brownfield campaigns, and they try to obtain good, long-term deals.

The secret for a sustainable business is to have a solid strategy to survive during the low cycles. Administration costs must be stable and the company structure needs to be able to support the operations, regardless of you having five or 30 machines working.

What is your current footprint in Peru and the wider region?

We have 65 rigs across seven countries (Peru, Dominican Republic, Panama, Chile, Paraguay, Surinam and Colombia), covering diamond drilling, reverse circulation drilling and water wells drilling. In Peru we are expanding our local fleet to 27 rigs, expecting to work at full capacity during most of 2018.

What is your take on the incorporation of costly technologies for automation in mining exploration?

Safety consists of two aspects: good management and technology. At AK Drilling we achieved three full years with no lost-time incidents, and that shows that solid procedures are in place. The incorporation of the rod feeders and rod handlers goes hand in hand with the trend of having more procurement managers taking control of sourcing the drilling services. They decide that they want these technologies, but sometimes that may not be what they need for their particular projects. These systems are widely used in the oil and gas industry, however oil and gas drilling and mining exploration are very different things. In the oil and gas industry, you spend months on the platform, and each pipe weighs half a tonne. In mining exploration, the rods weigh 35 kilograms, and you are on a platform for just a couple of weeks. In mining, you need an agile setup and competitive costs. Also, with these systems, the pipe is held up in the air, which raises some safety questions as well. At the end of the day, it is the end user (the geologist) who needs to decide what is best for each particular project.



Do you expect more players to come to Peru to conduct exploration campaigns?

Today we are seeing political issues, but we need to put things in context: the current instability is nothing compared to what happened in the 1980s, and it certainly does not seem that mining activities are going to be affected. With the higher metal prices, companies got the ball rolling and now you cannot stop all this exploration. Since last year, we have already worked for around 15 different companies.

Miguel Ángel Arenas

General Manager
GEOTEC



Can you update us on Geotec's recent developments?

In 2017, we doubled sales and increased our market participation by 6%. In Las Bambas, we incorporated seven hands-free rod handlers from Atlas Copco and Mining Parts, so the whole drilling campaign was hands-free, which was a big milestone. This year, we have won a contract to introduce intelligent machines for rod handling in underground mining. It is the first hands-free diamond drilling campaign for underground mining in Peru. We now have 32 machines working, which is 50% of our fleet. Two years ago, we only had 12 machines working. In early 2017, clients were concerned about price but the market has changed and companies are more inclined to invest in newer technology and pay a slightly higher price. For underground drilling, around 90% of the country's fleet is working. In open pit, the occupation rate is probably 75% whilst last year it was only 30%. We have a three-year contract signed at Yanacocha as well as fairly substantial contracts with Las Bambas, Tantahuatay and Marcobre.

What has been key to Geotec's success over the last year?

I believe our added value of incorporating hands-free rod handlers is what has boosted our market participation. Just this year, we have incorporated eight new hands-free machines to our fleet. Also, traditionally we have been a surface drilling company – we were very happy to start working with Yanacocha on underground activities, because our machines there are cutting-edge. Having intelligent machines with hands-free rod handlers in underground operations is a great achievement.

What are your goals for 2018?

By the end of 2018, we expect more than 50% of our fleet to be totally hands-free. We believe that this market recovery is solid and sustainable, so we are spending a lot in the latest technology. If you include the training required, a hands-free rod handler for a surface rig can cost US\$450,000, while a brand-new drilling machine costs US\$600,000. Not all clients are willing to pay more for their drilling, but for us this amount is a long-term investment where we are also improving productivity, efficiency, and safety. So far, with our hands-free rod handlers, we have not had one single incident.

Belisario Tijero

General Manager **EXPLOMIN**



How has Explomin benefited from the improved exploration segment?

2017 started with a lot of uncertainty: during the first half of the year, the market was tremendously conservative. However, as confidence built over the stability of metal prices, in the second half of year companies decided to invest heavily on exploration, to the point that we were drilling actively during the last months of the year, even December, which traditionally sees very low levels of activity. Following that trend, 2018 started on a good note, as we have been exceeding our sales targets. Now, we have a fleet of 60 drilling rigs, working at a 75% capacity. We should be working at full capacity later this year.

Could you elaborate on the long-term contracts you have with clients?

When the clients agree with this model, we sign three-year contracts. The rationale behind this is our innovation strategy: we have been pushing for the introduction of the latest drilling technologies, to ensure that the operator is less exposed to the machine. With the rod handlers, which we are already incorporating in underground operations as well

as surface rigs, we improve safety and productivity. By signing a long-term contract, we can afford these investments without increasing our rates. Our focus has been on these large, corporate clients.

As the demand for rigs and operators increases, are you not afraid that the long-term contracts will limit your margins?

The price per meter has already gone up, so clients that have signed long-term contracts have done a very good business. From our perspective, working with long-term clients reduces risk, and we can offer a wider range of services. We are starting to receive requests for horizontal or directional drilling, and we are focusing on those clients that require additional value.

How do you manage training?

We started our drilling school in the south of Peru last year, with a first group of 15 trainees. This year, we are planning our training in the Pasco area, with a focus on drilling helpers. This is very important to react during the peak moments. Last year, at some point we had 1,200 workers.

PERU MINING 2018

Industry Explorations

New Blasting

Technologies

If 2017 could be seen as light at the end of the tunnel for exploration-related companies, the blasting market remained tight with the arrival of new competitors and a continued focus on cost reductions and productivity. For Exsa, one of Peru's main rock fragmentation companies, innovation was instrumental to ensure the company's strong positioning in the open pit segment, where it has a 45% participation. Through the introduction of the Quantex technology, clients obtained cost reductions of 30% in the blasting process and 80% reductions in

CO2 emissions, according to Gustavo Gómez Sánchez, until recently the firm's general manager.

Gómez Sánchez highlighted that the second half of 2017 allowed for an increase of work volumes but that the higher price of ammonium nitrate presented some challenges as well. Moving forward, Exsa will continue expanding its scope, offering specialized blasting services for construction and non-production activities, and leveraging its brand-new initiation systems plant in Peru: "This is the only new plant built in the

region for more than 20 years, so the gulf in technology is vast. We will reduce our environmental footprint, as the plant will not use lead and is far more efficient. We are specializing in non-electric detonators, detonating cords, boosters, shock tubes, PETN and we are in the process of manufacturing end products as well," he said.

Innovation is also a key pillar for global blasting players like Maxam and Orica. Orica participates in Peru's mining industry through both blasting solutions and the provision of cyanide for gold mines. The company is introducing a wireless detonation system called Webgen that consists of a wireless primer and supporting equipment. Webgen is already being used in underground mines in Canada and Australia, and it should be tested in Peru this year. Gustavo Costa, general manager of Orica in Peru, provided more details: "As there is no need for wiring, Webgen allows our customer to have fewer people exposed to risks and for less time. Moreover, we are capable of significantly reducing the blasting time cycle [...] For example, in mines that usually have thunderstorms, the wireless process will allow work to carry on for longer and will reduce the stoppage time."

Finally, Spanish-based multinational Maxam is targeting growth in Peru through its Rioflex hydrogel technology, already in operation in Chile's large open-pit mining segment. According to Maxam's general manager in Peru, José Luis Alonso, the Rioflex technology offers 25% more energy than equivalent emulsion blends through a wider range of available densities.

Asked about how much the final price weighs on mining companies' tenders for blasting solutions, Alonso said: "In Peru we see that our customers are requesting value added propositions to optimize the total cost of their operations beyond the cost of drill and blast. This holistic view is what has enabled us to be successful around the world, and we see the industry in Peru moving towards this more sophisticated and smarter approach."



PERU MINING 2018 Industry Explorations



Gustavo Gómez-Sánchez

General Manager* **EXSA**

*Until August 2018

We have expanded our services to incorporate blasting in mine construction. Also, in the open pit market we have developed our service line with specialized blasting in non-production mineral areas.



Can you update us on Exsa's main developments in 2017?

2017 proved to be a year of change, following difficulties that stretched back to 2014. As 90% of our customers are in the mining industry, we had to develop a strategy to cut costs for our clients following the drop in mineral prices. We innovated our product line, introducing the Quantex technology, and that was a key milestone that led to us increasing our market share in open-pit mining to around 45%. The Quantex technology reduced blasting process costs for clients by 30% and reduced CO2 emissions by 80%. Although this technology definitely aided our growth, market margins were impacted due to the industry situation, and also due to the arrival of two new competitors to the market. Over the last year, however, the increased prices of Peru's minerals production have allowed for a sudden increase in work volumes in the latter half of 2017, and we expect this positive trend to continue in 2018. However, the increase in price of other raw materials, such as ammonium nitrate, has also presented some challenges.

What is Exsa's current strategy in regard to product portfolio?

Although we were previously seen solely as a producer of explosives, the market is perceiving us now as a rock fragmentation company. We have expanded our services to incorporate blasting in mine construction. Also, in the open pit market we have developed our service line with specialized blasting (non-production mineral areas). In terms of products, The Quantex technology has increased our capability to break a wide range of rocks (stronger rocks as well as softer rocks). It is a product that adapts well to mines that have high water content. Also, this year we will finish the implementation of the initiation systems plant, which will be 100% automated. This is the only new plant built in the region for more than 20 years, so the gulf in technology is vast. We will reduce our environmental footprint, as the plant will not use lead and is far more efficient. We are specializing in non-electric detonators, detonating cords, boosters, shock tubes, PETN and we are in the process of producing end products as well.

Which major mines are you collaborating with in Peru?

We have been working for Southern Copper Corporation for four and a half years and have extended the contract for another three years. We are also in Toromocho, Antapaccay, Cerro Corona, Yanacocha, and La Arena. In underground mining, we are working with Glencore, Minsur, Nexa Resources, Pan American Silver, and Buenaventura.

What is your approach towards innovation?

Innovation is part of our DNA. We are not a large multinational so our focus is to develop the technology that helps our customers in their objectives. Therefore, the Quantex technology has become such a priority. We are also seeing new developments in other segments; we are continuously aiming to develop a product line following the demands from the market.

From a provider's perspective, what is your view on safety in Peru's mining sector?

Every operation and company is different, but I think safety awareness has increased a lot in the past few years, although we are now facing new challenges. A key issue is how to manage safety in the down-cycle. We have to invest more in training and safety behavior. In our case, we developed new initiatives working on people's behavior which led to a safer and more efficient blasting process. I believe this is the key to reducing the mining sector's fatality rates.

What is Exsa's focus for 2018?

We will carry on focusing on Peru and Chile. The aim in Peru will be to maintain our position as an industry leader, while in Chile it will be to consolidate our market entry. Our key pillars for Chile include the Quantex technology and good logistics management and also taking advantage of our new initiation systems plant in Peru. Secondly, we want to maintain our value offer to our customers, but we need to improve our margins, which were highly impacted in the last three years. Finally, we will continue our strong focus on improving our safety records by putting emphasis on training.

Can you tell us about Orica's recent developments?

As the Peruvian market has now grown from three competitors to five, we are looking at new ways to innovate our product line and remain ahead of the competition. Our operation in Peru currently consists of 400 employees and we also cover Ecuador from here. During 2017, we were able to extend our main contracts, including Las Bambas, Cerro Verde and the contract of electronic blasting systems (EBS) with Cuajone and Toquepala. In addition, we secured a contract with El Brocal. Besides blasting, the other half of the business focuses on cyanide. Peru is one of the biggest cyanide markets for Orica.

What solutions is Orica providing?

Orica is always looking for new solutions to make the operations safer and more productive. Flexigel is an explosive that produces a softer blast that results in lower vibrations and less dust and noise, which is perfect if a mine is operating near a community. At the other side of the blasting energy map, we have Vistan/Vistis, a product for harder rock, which has up to 2.5 times more energy than the normal explosive, and allows mines to get

the precise rock fragmentation required by the processing plant. Furthermore, we have explosives that deal with high levels of water concentration.

We also have IT solutions like Blast IQ that provide our customers with real-time technology of the blasting process so they are able to understand the quality of each blast. Besides, Orica introduced electronic detonators several years ago and we are now further innovating with the use of a wireless primer system, called Webgen. This will be revolutionary in mines.

Could you develop on this new wireless technology?

The Webgen technology consists in a wireless primer and supporting equipment. As there is no need for wiring, it allows our customer to have fewer people exposed to risks and for less time. Also, with this technology we are capable of significantly reducing the blasting time cycle, which translates in millions of dollars in savings for our customers each year. For example, in mines that usually have thunderstorms, the wireless process allows work to carry on for longer, reducing stoppage times.

José Luis Alonso

General Manager
MAXAM



What is Maxam's positioning?

Maxam is a global company specialized in energetic materials. It was founded in Spain more than 140 years ago. To-day we provide blasting solutions with a global industrial footprint. We are experts in the smart application of energy during drill and blast activities, and we can help our customers unlock important savings downstream in their operations, from loading and hauling to crushing and milling, reducing the total cost of comminution.

Maxam began to work in Chile in 2004 and currently employs 250 people in the coun-

Maxam began to work in Chile in 2004 and currently employs 250 people in the country. The company is also a market leader in Bolivia and has participated in the Panama Canal expansion project with more than 2,700 blasts, many of them under water. In Peru, Maxam re-entered the country in 2009 after our first steps in the 1980s.

How does your Rioflex technology compare to other solutions available?

Maxam is one of the most experienced manufacturers of bulk products in the world. We supply globally the whole bulk product range, from pure gassed emulsions to different emulsion and porous ammonium nitrate and fertilizer-grade ammonium nitrate blends. Additionally, our Rioflex bulk technology offers 25% more energy than equivalent emulsion blends through a wider range of available densities.

In Peru we see that our customers are requesting value added propositions to optimize the total cost of their operations beyond the cost of drill and blast. This holistic view is what has enabled us to be successful around the world and we see the industry in Peru moving towards this more sophisticated and smarter approach.

What other solutions do you have to assist companies with their blasting needs?

We have our own line of electronic detonators called Riotronic. Besides, we have many technology developments, including the use of drones, fume detection, selective loading and other applications. Apart from specific solutions, we bring more than 140 years of international experience and a global presence. This translates in a deep market and customer understanding and the ability to work in any kind of project and conditions.

140

PERU MINING 2018

Efficiency and Environmental Solutions

Looking at better performance and more sustainable business practices

Laboratories: Process Integration

Laboratories in charge of geochemical analysis are having to expand their capacity to keep up with demand. Certimin, for instance, can now handle 1,500 samples per day, and is opening up a sample preparation facility in Cajamarca, which adds to the existing sites in Juliaca, Arequipa and Lima. The company has consolidated its focus on geo-metallurgical services, whereby it starts looking at the metallurgy from the first phases of exploration. Miguel Caillaux, director of Certimin, provided more details: "The geo-metallurgical approach requires the samples to be handled properly, so they can be used in both geochemical and metallurgical tests. At the end of the day, you need to decide on the best mineral composite to be sent to the plant. If you do not do the right job, you will send ores with high variability, causing the plant to obtain lower recovery rates. Over a long period of time, the impact of one percentage point in the recovery rate can be huge."

Global company Bureau Veritas is also expanding its reach, with the opening last year of a new sample preparation facility in Arequipa. The company is a leader in the outsourcing service of laboratories at the mine site, with seven such operations country-wide. Jameson Linares, director of Metals and Minerals at Bureau Veritas, affirmed that service providers have been increasing their value proposition so miners and explorers can focus on their core businesses: "We do not only provide the geochemical analysis, but we make sure that the sample follows the right procedure from the moment it leaves the drilling rig,

with the right cutting, labelling, storage, as well as some initial parameters that can be used further down the value chain. This is very useful for juniors who do not have a big team to take care of all these aspects."

Cyanide Control

Peru's mining industry uses large amounts of cyanide, which is one of the main cost drivers for gold producers. In this context, making sure companies use the right amount is key from both an efficiency and from an environmental perspective. CyanoGuard, a Swiss company with a new technology for instant cyanide detection, has entered the Peruvian market with the idea of changing the way mining operators manage their cyanide usage. "If you do not use enough cyanide you lose gold, but if

145>>



Industry Explorations PERU MINING 2018

Miguel Caillaux

Director **CERTIMIN**



What are Certimin's main services?

The trend in the market is to anticipate the metallurgical needs as soon as exploration starts. This requires the samples to be used in both geochemical and metallurgical tests. At the end of the day, you need to decide on the best mineral composite to be sent to the plant. If you do not do the right job, you will send ores with high variability. Over a long period of time, the impact of one percentage point in the recovery rate can be huge.

How have you increased your participation in geo-metallurgical services?

We work in an integrated manner. Just two years ago, convincing companies to use the geo-metallurgy approach was a dream, but lately we have been successful at convincing geologists and metallurgists of the need to work together.

Could you give us an example of how you are incorporating new technologies?

Mining companies are reprocessing old tailings that offer good economic parameters at today's prices. In this respect, because this

is low-grade material, we are working with a new technology called HydroFloat, to do an initial concentration that will allow the client to embark on the traditional flotation process afterwards. Besides this, in the last Perumin we acquired an automated flotation cell from Chile. The laboratory operator typically has a strong influence, but here the automated cell mechanizes the process, so it can continue with no variation, regardless of which metallurgist is on shift. Over the long run, these small variations can have big impact on the final results.

How is Certimin doing in terms of laboratory capacity?

We have acquired additional equipment to make sure that we can handle 1,500 samples per day, with no bottlenecks. We have plants for sample preparation in Juliaca, Arequipa, Lima and we are opening a new facility in Cajamarca. Besides, we also run some laboratories on site for mining companies. We always aim at having at least 30% spare capacity. When you step on that spare capacity, that means you have to invest and expand further.

Jameson Linares

Director Metals and Minerals **BUREAU VERITAS**



Can you outline Bureau Veritas' presence in the mining industry?

Our experience in mining business comes from previous acquisitions, including Geoanalítica and Cesmec in Chile. In 2010, BV performed the global acquisition of Inspectorate before buying Acme laboratories in 2013. Now, we have consolidated all these companies under the Bureau Veritas label, providing services in commodity trading and the upstream part of the business. Metals and Minerals represents 38% of Bureau Veritas' total revenue. If we add the revenue from our Industry and HSE divisions, mining represents 60%.

How do Bureau Veritas' services help during a project's full value chain?

In Metals and Minerals, we offer value through the integration of the whole process. We do not only provide the geochemical analysis, but we make sure that the sample follows the right procedure from the moment it leaves the drilling rig, with the right cutting, labeling and storage, as well as some initial parameters that can be used further down the value chain.

Could you elaborate on the capabilities of your laboratories?

We have a main laboratory in Callao, that we have expanded recently. We also have two laboratories for sample preparation: a brand new laboratory in Arequipa, that we opened last year, and another one in Chorrillos. In Arequipa, in just a few months of operations, we have already doubled our capacity, from the initial 3,000 samples per month to 6,000 samples per month. Additionally, we provide all the service of outsourcing of laboratories on site. Today, there are 18 outsourced laboratories in the country, and seven of them are run by Bureau Veritas.

How diverse is Bureau Veritas' client base within the mining industry?

In 2013, we were focused on base metals, with Volcan as one of our main clients; we also ran laboratories for Nexa and Pan American Silver. After this, we started working with large copper projects, with clients like Las Bambas, Hudbay and Antapaccay. We then expanded our reach to serve gold operations: we do all the sampling and the surveying at Tambomayo, and today one of our main clients is Marsa. So, we now have a diversified reach in base metals, large copper operations and gold mines.

142

PERU MINING 2018

Benedikt Kirchgässler & Mathias Cherbuin

BK: CEO MC: CTO **CYANOGUARD**





What inspired you to create a company based on solutions for cyanide?

BK: Whilst studying chemistry at the University of Zurich in 2015, I came across a very promising cyanide sensing technology. Cyanide is a bulk chemical required in many industries, and is not only very toxic, but also currently available monitoring methods are prone to errors and interferences when applied in various processes. Therefore, we saw a need for a more efficient detection method. We set up the company and got the first prototypes and production going.

How did you see an opportunity to move into mining?

BK: CyanoGuard has been working with producers of cyanide from the beginning. We followed the supply chain and noticed that one of the biggest applications of cyanide is in mining, where it is used on a massive scale. We went to Australia to visit Orica, and then came to Peru where we have been speaking to Shahuindo, Buenaventura, Yanacocha as well as other potential partners accompanied by our local partner in Peru, Aqa Tec S.A.C. MC: CyanoGuard started in the chemical industry, performing waste water and effluent analysis, which led us to research where our product could have the greatest impact. The mining industry is quite conservative, but at the same time open to innovation. The CyanoGuard product is efficient, cost effective, digitally state of the art, and environmentally friendly, so it ticks all the boxes for the mining industry.

Can you outline the differences of CyanoGuard's approach to a traditional laboratory test?

BK: The traditional cyanide detection test takes around two hours and, as the majority of laboratories are not on-site, when you factor in the transportation time, this process can take days. CyanoGuard takes cyanide testing out of the laboratory and on to the leach pads. A liquid sample is taken with the CyanoKit, and in under 90 seconds you have the result, which is also sent automatically to an online platform.

What is the impact of your solutions in terms of productivity and environmental monitoring?

BK: Cyanide is one of the main cost drivers in the gold mining industry – if you do not use enough, you lose gold, but if you use too much you incur in high costs to eliminate the excess cyanide, on top of what you already paid for cyanide you did not need. Applying the correct amount is vital for mining companies who work with such large quantities. The cyanide elimination costs can be three times as high as the price of cyanide. MC: Our method gives mining companies the opportunity to correct their cyanide usage a lot faster. In addition to the cost benefit, it is also much cheaper and quicker to do the environmental testing. The measurements taken can be made available to the communities and the wider public so the process is more transparent. You do not need training to

use the CyanoKit, and it can be handed out to artisanal miners and community members.

How does CyanoGuard fit with the global drive for digitalization?

MC: The CyanoSmart solution uses cloud technology and decentralized computers, sending data that lets the user know when and where the sample was taken, and its specific measurements. For the big data approach you need a lot of different data points. Our solution provides mobile lab-grade cyanide measurements stored in the CyanoChain blockchain. It is easily integrated in already existing process management software, and aims to become the gold standard for cyanide monitoring in the 21st century.

What are the key objectives for CyanoGuard moving forward?

MC: We are currently focusing on the Peruvian and Argentinian markets, but in the long term we want to support any gold mine around the world with our solution. As mine closure projects become more prevalent in Peru, the fact that the CyanoSmart solution offers real-time monitoring off-site should be attractive for mining companies.

BK: From the beginning, we have always had an international outlook, serving clients in every corner of the world. We would like to see the cyanide extraction aspect of the mining industry made more responsible, transparent and efficient, and CyanoGuard can contribute to this change.

MINING AND ENVIRONMENT



CREATING LONG TERM RELATIONSHIPS WITH OUR CUSTOMERS

CHEMICALS FOR THE MINING INDUSTRY

- Sodium Cyanide
- Copper / Zinc Sulfate
- Hydrogen Peroxide
- Flotation Reagents (frothers/collectors)
- Defoamers
- Flocculants / Coagulants
- Antiscalant / Corrosion Inhibitors

ENVIRONMENTAL PROGRAMS

We provide solutions based on Advanced Oxidative Processes

- Cyanide Destruction
- Industrial and Domestic Effluent Treatment
- Acid Water Treatment
- Gas Washing / Cleaning



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Eduardo Galdo

Sales Manager Mining QUIMTIA



How did Quimtia transition to being a solutions provider?

In 2003, we saw an opportunity to not only sell chemicals, but to implement solutions through technology. Due to the numerous gold and silver mines that have to deal with cyanide contamination in discharge streams, there was a strong opportunity to implement these solutions in the Peruvian market. We started to treat this type of discharge, eliminating cyanide, removing other contaminations like extra metals, regulating the PH and reaching standards that the law required. These environmental solutions took our portfolio to another level. Due to this, we started selling plants that stored our chemicals and controlled the chemical dosage. We have now implemented a solutions strategy to all our products, incorporating planned visits and analyses of the water. We aim to understand our clients better than they understand themselves.

What is the breakdown of Quimtia's products and solutions?

We divide the company into three different product streams. Commodities, including copper sulfate, sodium cyanide and activated carbon contribute 25% of the business, mostly through spot trades. Advanced oxidation technology, like the hydrogen peroxide that is used for cyanide destruction, accounts for 30%. We are constantly looking at new

technology to improve leaching in gold and silver mines and improve metal recovery in flotation cells in base metals mines. So, other specialty products, like antiscalants and flotation chemicals, make up 20% of the business. The remaining products we offer focus on engineering services and the specialized plants.

Environmentally speaking, do you think clients are more willing to invest resources?

There are now more environmental regulations from the government as local communities are starting to wield greater influence. In the past two years, there were numerous protests surrounding potential environmental issues. As Quimtia, we have to provide solutions that will not only be cost effective, but also reduce the environmental footprint of our clients. There has been a clear shift in the past 10 years as the mining industry has become more conscious towards their sustainability and environmental impact.

Does the imminent closure of mines in Peru represent an opportunity for Ouimtia?

Mine closures are a lengthy procedure and there are new technological processes that we have developed to help companies with this. A mine at closure stage will have a lot of water stored in tailing dams and also underground, that needs to be treated in order to remove the cyanide or biological contamination. We are working with Nalco to develop their WaterShed business in Peru. This technology increases solid percentage and water recovery while improving deposits and increasing the life of a tailings dam. We believe that it is now the perfect opportunity to implement it, as tailing dams reach full capacity and therefore have to constantly expand. Besides, at Quimtia we are also trialing a process for the remediation of contaminated soils.

How was 2017 for Quimtia and what are the objectives for 2018?

To understand 2017, we need to look at 2016, which was a bad year for the company and the industry as a whole. In 2017, the plan was to return to the numbers of 2015. 2017 was a great year in which we exceeded that target, and we expect further growth in 2018. We are already working on several new projects. With high copper prices and gold and silver trading at stable levels, we believe this is the year to invest.

<< 141

you use too much you incur in high costs to eliminate the excess cyanide, on top of what you already paid for cyanide you did not need," explained Benedikt Kirchgässler, CEO of CyanoGuard, who also affirmed that the cyanide elimination costs can be three times as high as the price of cyanide. CyanoGuard offers a solution that allows cyanide detection in just 90 seconds, foregoing the need to take a sample to a laboratory, while all the information compiled can be sent to the cloud in real time. With modern mine closure plans becoming more common in the years to come, and with an increasing push for more transparency in environmental monitoring, the company expects to achieve significant growth in the precious metals industry in the years to come.

Chemical Supplies

Following market trends, providers of chemicals are moving away from the mere

supply of products to offer higher-value solutions and consultancy support. Quimtia, a company with a footprint in the wider region but whose mining practice is mostly focused in Peru, has seen specialties increasingly overshadowing the more traditional business of commodity trades, where the company provides copper sulfate, sodium cyanide and activated carbon.

It was on the environmental front that Quimtia started its diversification: "Due to the numerous gold and silver mines that have to deal with cyanide contamination in discharge streams, there was a strong opportunity to implement related solutions in the Peruvian market," said Eduardo Galdo, sales manager of mining at Quimtia. "We started to treat this type of discharge, eliminating cyanide, removing other contaminations like extra metals, regulating the PH and reaching standards that the law required. These environmental solutions took our portfolio to another level."

Today, advanced oxidation technology, like the hydrogen peroxide used for cyanide destruction, contributes to 30% of Quimtia's business, while other niche products used to improve recoveries in both leaching and flotation processes already make up 20% of revenue.

Ixom, a company created from the divestment of Orica's chemicals division in 2015, is also increasingly focusing on regular supply relationships for mining clients rather than spot commodity trades. The company's mining business grew by 30% last year, triggered by contracts in water treatment and flotation with large copper producers. Claudia Marchini, country manager of Ixom, declared: "Our chemicals business was mainly based on commodities, which allowed us to start relationships with large customers and increase our volumes in the past. After that, the fall of copper and other mineral prices represented an opportunity for us to offer specialty chemicals for mineral processing."

Ixom covers several business areas across the mining industry supply chain, including the developing of emulsifiers for explosives, and it has a plant in Chile where it produces flotation agents. ■

Claudia Marchini

Country Manager

IXOM



Following its departure from the Orica structure, what is Ixom's new role as an independent company?

Ixom commenced as a standalone business in 2015, separating from Orica Australia. With more than 1,000 employees globally, Ixom is the market leader in water treatment and chemical distribution in Australia and New Zealand, with a growing presence in the Americas and Asia. In Latin America, we have a specific focus on Mining, Life Sciences, Industrial and Construction.

The mining industry is very cyclical. How is the mining business going for Ixom?

Our chemicals business was mainly based on commodities. This allowed us to start relationships with large customers and increase our volumes. The fall of the copper and other mineral prices in the past years represented an opportunity for us to offer specialty chemicals for mineral processing to the larger mining operators. This has proven successful and we currently work closely with these key mining companies, solving their challenges.

What has been your strategy in the mining sector?

As growth will be mainly based on copper development, in the past two years we have focused on specialty products. In line with this, our strategy for mining is to improve mineral recovery, with tailor made flotation agents produced in our plant in Chile. Over the past year, we closed important new contracts with major mining operators. Also, we have a growing flocculants business, and we have also developed emulsifiers for explosives with key clients.

How can Ixom's products help improve recovery rates as ores become more complex?

Each mine faces its own challenges, whether new greenfields or mature sites. Ixom has specific products and applications to improve productivity in oxides or sulfides of copper, zinc, lead and precious metals. Thus, in solvent extraction, Ixom has a unique product and service proposal to ensure the highest productivity and technical support. In copper concentration, we develop customized collectors according to each specific ore mineralogy.

Outsourcing

A wide variety of providers assist mining companies with their day-to-day logistic needs

Culturally speaking, Peru is still a country where mining companies like to control many processes in-house in order to save costs. Coming out of a mining downturn, this is even more the case, considering the cost-reduction efforts the industry has seen across the board. Yet, the levels of expertise of specialized providers are very hard to match, and the new impulse in mining investment and project development should boost growth for all those companies, because miners will need to concentrate their focus on production.

Aspects like feeding and providing accommodation for the workforce on site every day or having vehicles to move personnel around can certainly be seen as non-core activities, however not because of that should mining operators push margins down to the limit, because serving mining clients presents significant challenges for providers.

"Mining companies always want more competitive prices, but for us it is essential to look at our margins, because our business is very intensive in working capital," said Alfonso de los Heros, country president at Sodexo, a multinational company in the hospitality services sector. "Therefore, we never engage in a price war just to win a

project – that is short-term gain, long-term pain."

Taking advantage of economies of scale, Sodexo has been able to progressively introduce new technologies that will allow the company to offer more competitive rates.

The same applies to players supplying vehicles under the operational leasing model, like Arval Relsa, who can compare vehicle performance worldwide. Commercial director Vicente Monasi gave more details: "We can show any international customer what cars they are using in any country and what the total cost of ownership (TCO) is for each of them. This way, we can recommend our clients what the best vehicle is for each country, each business need and each brand."

This way, providers can expand their service offering and offer a more comprehensive solution. Puma Energy's main business, for instance, is the provision of fuel, but the company, part of the Trafigura group, can also build and operate fuel storage facilities within the mine sites if required by clients. Meanwhile Hermes, a company traditionally involved in the transportation of gold and silver out of the mines, can also build

We operate in 49 countries in the world and work with different refineries. Most of the product we import into Peru comes from refineries in the Gulf Coast of the U.S., and it has very good quality. In Peru, for instance, you have a limit of 50 parts per million (ppm) of sulfur, and our product has 10 ppm or less. This is a great advantage for underground mining.

 Víctor Hugo de Dios, general manager, Puma Energy





and operate the security vaults at the mines, providing significant advantages, as explained by José Antonio Yataco, Hermes' commercial manager: "This way our clients have to pay lower insurance premiums, and also you reduce to zero the risk of systematic theft and the kidnapping risk for mining employees. Finally, because the international buyers have the certainty that the whole process is secure, they approve their purchases quicker, significantly improving payment periods," Yataco concluded.

Fernando Martínez

General Manager **AVIS**



What have been Avis' highlights over the last 12 months?

In 2017, we consolidated our position with a significant 50% growth in our fleet, so we already have 1,700 vehicles. We strengthened our after sales team, including our operations, fleet management and customer service areas. We migrated to the new SAP HANA management system and we kept our ISO 9001 certification. We have an alliance with a new telematics provider to obtain information on a number of variables, such as fuel consumption and how the user is driving. Bad driving can lead to an accelerated deterioration of the vehicle and the information can also help prevent accidents.

How is the market evolving for operational leasing?

The market has become very competitive in terms of rates. The current economic situation is not helping, however we know that when new investment projects are approved, we will see significant growth rates. We continue our focus on client diversification because we do not want to rely on one large single client. Our typical customer has between 30 and 40 vehicles. We also serve small customers that offer good margins. So far, we have been renewing 98% of our contracts, which means we are providing a good service over the rental period.

Edmund Egg

General Manager **SK RENTAL**



What is the size of your equipment fleet right now?

We have about 950 units. We are constantly renewing the fleet and we are waiting for the demand to increase. Currently, the construction companies are not in a position to invest in capex; they are more likely to look for leasing. The good thing about belonging to a group that is active in five countries is that we can move machines across the different subsidiaries, although in Chile the demand is also increasing, which makes this more difficult. Demand in mining is cyclical and massive, but then it disappears.

How has rental penetration evolved in the market?

In 2010, rental penetration began to increase very abruptly in the construction sector. One of the factors was the arrival of foreign construction companies, mainly from Europe, which had a different vision. Peruvian construction companies used to buy 90% of the equipment instead of renting it. In the current market, leasing is going to be increasingly important because there are still many construction companies coming from abroad that do not bring assets. On the other hand, Peruvian construction companies are not in the best position to buy equipment.

Vicente Monasi

Commercial Director

ARVAL RELSA



The market penetration of renting is very low in Peru. Why do you think this is?

The operational leasing means you are transferring the risk to a third party. In Peru's culture, however, owning the vehicles is directly related to pride and status, and people also make mistakes when they compare the prices of operational leasing and financial leasing. For instance, they do not realize that financial leasing does not include maintenance, operational and accident costs. If you look at all the variables, the operational leasing is always the best option.

According to your data, what is the size of the market right now?

Our estimation is that Peru has a fleet of 12,500 units in operational leasing, which represents just 2% of the country's 2.6 million vehicle fleet, and this year we expect 18% growth in the market. There are five main players in our business, and we have 25% of the market with 3,147 vehicles as of April 2018. For 2020, our goal is to have 5,500 vehicles in Peru. Currently, mining represents 30% of our business. While mining clients require large volumes, unfortunately the margins are low because the vehicles suffer much more than in other industries.

Industry Explorations PERU MINING 2018

Alfonso de los Heros

Country President **SODEXO**



Which segments have been driving Sodexo's growth?

Even though 2017 was a slow year at the beginning, it ended up evolving positively. We had strong growth rates of close to 20% in the corporate segment, while we also had growth in mining of between 5 and 8%. This is quite good considering that the mining market has not expanded. In mining, our largest operations are Las Bambas, Chinalco, Lagunas Norte, Bayóvar, and we also serve Hochschild and Buenaventura.

How can you strike a balance between offering competitive rates and having a sustainable business?

Mining companies always want more competitive prices, but for us it is essential to look at our margins, because our business is very intensive in working capital. Therefore, we never engage in a price war just to win a project -that's short-term gain, long-term pain. Our challenge is to grow being both competitive and profitable. This means controlling our cost structure and adopting new technologies. In Australia, for instance, when you arrive in the mining camp, you do not go through a front desk to get the keys to your

room, you just receive a QR code that gives you direct access.

What has been a milestone for innovation in Sodexo Peru?

In Peru, we implemented our 'Evolución' program, whereby we introduced cuttingedge technology in our kitchens to reduce the number of people, eliminate the need for fire, have a better product, and have personnel more focused on the service and not so much on the cooking. Peru was a pioneer country in this program, and we transferred this knowledge to other countries in the region, and recently also to India.

What is the vision for Sodexo in Peru as it celebrates its 20th anniversary?

Celebrating 20 years in Peru is an important milestone. We entered the country to support the construction of Antamina; we then participated in Camisea. We remain a leader in the market in a very complex business that many other global competitors decided not to pursue in the country. We have grown fourfold over the last decade, from 30 million euros in sales to 120 million euros, and from 1,000 collaborators to over 6,000 now.

José Antonio Yataco

Commercial Manager **HERMES**



How does Hermes assist mining clients?

We do the transportation of the precious metals from the vault of the mining company to our own vault, either by road or plane. We also take them to the airport. We monitor the whole export process, from the moment the gold or silver enters the facilities of the logistics operator, all the way until the plane takes off. Additionally, we take care of the transportation of activated carbon and gold and silver precipitates, while we can provide ancillary services like the provision of cash to pay the employees in areas where there are no banks.

Could you provide more details about your vault management service?

It takes us several months to set up the whole infrastructure, but once it is in operation, it brings enormous benefits to the clients. For instance, because all the responsibility for the custody of the metal is on Hermes' side, the clients have to pay lower insurance premiums. Also, you reduce to zero the risks of systematic theft and kidnapping of mining employees. Finally, because the international buyers have the certainty that the whole process is secure, they

approve their purchases quicker, improving payment periods. We already provide this service in four operations.

What are the growth opportunities for Hermes in the mining sector?

We have grown by 13% annually over the last three years and we have more than 90% of the mining market share. We are committed to continue investing in this business as we are renewing our fleet for larger capacity in transportation and storage. This year we should grow by 10%, and the mediumterm prospects are also positive: until 2021, there are seven projects that should enter production, four in gold and three in silver.

How do you ensure you do not work with companies involved in illegal mining?

We have a strong focus on compliance, divided in two parts. First, we do the due diligence before starting to work with a new client. Then, once the relationship is ongoing, we need to make sure that everything is by the book. As an example, we do not work with metal traders, because we cannot have the certainty of where they are sourcing their mineral from.

PERU MINING 2018 Industry Explorations

Mining Safety and Risk Control

Reversing the increase in fatalities must be a priority

After years of a significant decline in fatalities, this trend recently reversed in Peru. In 2015, there were 29 deaths in Peru's mining industry, but this figure steadily increased to 34 in 2016, and 41 in 2017. It is unclear whether a more dynamic mining market will have a positive or negative impact on safety records in 2018. So far, during the first half of the year, 16 workers have lost their lives, which, looking at full-year projections, would be better than in 2016 and 2017, but still a worse figure than we saw in 2015.

Reflecting on the inherent risks of underground mining, Víctor Gobitz of Buenaventura, said: "In underground mining, the main risks are related to rock fall and ventilation. We are aware that most of the fatal accidents happen there, so we hope that with the better mineral prices mining companies will invest more resources to address these issues. Obviously, the more workers we have in the industry, the higher the risk, but it is a challenge that needs to be addressed in Peru."

Furthermore, Gustavo Gómez Sánchez, until recently general manager at Exsa, a blasting solutions provider, highlighted that more action needs to be taken to manage safety in the down-cycle with more investment in training. Despite this, he said that safety awareness has increased a lot in the past few years.

The culture towards safety awareness is clearly a key pillar to dealing with the rising fatalities. Adolfo Vera, president and CEO at Southern Peaks Mining, believes that the fatality rate in mining is centred on the mining culture. "There has traditionally been an attitude that not wearing protective gear or entering into unsafe activities is a sign of bravery, but it is indeed rather a sign of stupidity and we are changing that," he said.

Changing attitudes and the overall culture towards safety is therefore key to reducing fatalities in 2018. According to Greg Jackson, managing director of Byrnecut Offshore, a large underground contractor: "Education, training, disciplined and quality execution of work and quality supervision will result in the most optimum safety conditions."

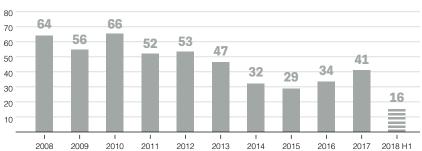
Rock-fall related accidents may be caused by the wrong support solution, or by a bad mine design leading to rock burst. Besides, many workers fill all the safety forms because they have to, but then there is not enough supervision once the shift starts. There is a culture of overconfidence, where workers believe nothing will happen to them.

- Frank Vásquez, sales manager, New Concept Mining



TOTAL DEATHS IN PERU'S MINING INDUSTRY

Source: MEM



Industry Explorations PERU MINING 2018

Carlos Felipe Rizo Patrón

Corporate Vice President RIMAC SEGUROS



Can you give us some background on Rimac's involvement with mining?

Rimac Seguros, part of the Breca group, is the oldest and biggest insurance company in Peru, with annual sales of around US\$1.4 billion, assets of more than US\$400 million, and over 4,000 employees. Rimac Seguros' corporate arm represents around 70% of the company's total premiums, of which mining makes up 25%.

When a mining project begins, the first insurance taken is always related to construction. We have insured the construction of big projects in Peru, such as Toromocho and Cerro Verde. After that comes the operational insurance when the mine is up and running. This includes insurance for fire, natural risks such as floods and earthquakes, terrorism, equipment and machinery, third party liability, and finally business interruption, which is critical. Rimac has its own local capacity to provide all of this, but also Rimac is the Peruvian representative for 12 global reinsurance and insurance companies, and shares information and data from the most developed mining operations around the world. We employ experienced engineers who know the mining industry in Peru inside out and help us give the right coverage at the right price.

What are the main challenges for miners from a risk management perspective?

The first is business interruption; if you cannot operate, you lose a lot of money and efficiency. Secondly, a tailings dam failure is very dangerous, not only for the operation but also the local communities and the environment. The social conflicts are another big risk; mining companies must work closely with the government and the local communities in a respectful and committed manner. Then, there are some risks the insurance companies cannot assume, such as penalties from the government, political issues, and long lasting community conflicts that cause severe delays.

What are the key areas of innovation for Rimac Seguros?

Three years ago, we started to commercialize an innovate product for potential mine rescue situations, and now we are seeing an uptake in requests for cyber-risk insurance and also pollution damage. If you ask all the companies what their goals are for the next five years, they will all mention digitalization. We have an excellent program that protects companies from hackers that could steal valuable data, information and money.

Tom Hollidaγ

Head of Mining
WILLIS TOWERS WATSON



What are the main risks associated with mining operations?

On the technological side one of the growing risk areas is cyber insurance - the protection against hacking, associated physical damage and data being stolen. There is project risk relating to the construction and erection, which involves cargo in transit coming into the country. Environmental insurance is under the spotlight following the Samarco dam failure. Care and maintenance risk is also important to consider - getting those assets up to full speed again brings along risk as a result of perhaps unclear previous maintenance plans. Then there are the main operational risks associated with the project such as fire, explosion, flood and machinery breakdown all the way through to delay in the start-up of a project.

What insurance requirements come along with financing projects?

One thing I impress upon mining companies is the importance of understanding your exposures. Some miners tend to be more price focused on their insurance than others. Cutting costs on insurance comes with major risk,

so it is important for them to understand their ability to handle the exposure.

What is the standard in the industry in terms of the risk that each company is willing to take?

There are huge differences. The retention that you take is an exposure to the balance sheet and exposure to investors and shareholders. Companies have different appetites for risk, which affect the type and amount of insurance they buy. For instance, there are mining companies that do not buy insurance; they have strong enough balance sheets and captives with bigger capital than some insurance companies.

Some of the smaller companies also have captives. They may not have sufficient capital in their captives to accept all of their risk, but they may place some of their risk, usually primary risk, in the captive. It depends on how they want to manage their capital. Willis Towers Watson has a large analytics team that assess the company's financial position and advises on what they are economically capable of buying or retaining without breaching certain predetermined tolerance levels.

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