

GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS

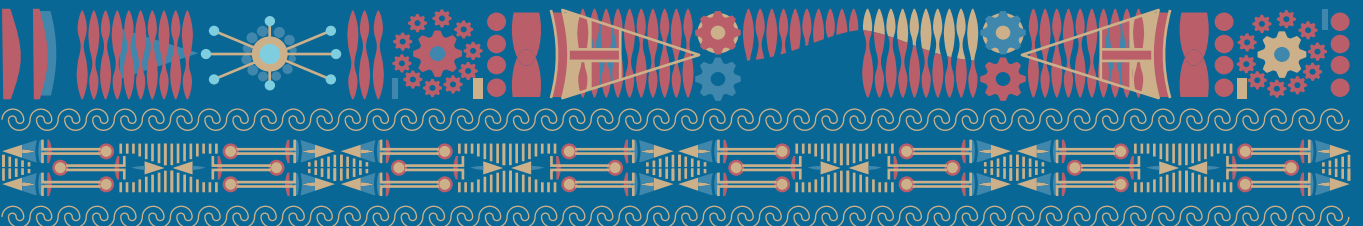


PERU MINING

2016



*New Government - Mining Production and Exploration - Safety
Engineering - Environmental - Construction - Technology - Services*



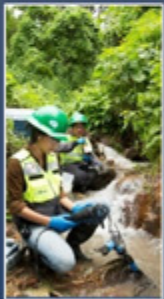
New Leader in Precious Metals



Tahoe operates La Arena and Shahuindo Gold Mines in Peru

Personnel

- ✓ +72% employees are from local communities
- ✓ Paid ~\$23 million in employee salaries
- ✓ Paid ~\$15 million in employee benefits



Social Investments

- ✓ Vocational Training Center
- ✓ Nutritional Anemia Prevention
- ✓ Guinea Pig Farming
- ✓ Livestock Vaccination Clinics
- ✓ Trout Hatchery
- ✓ Reforestation
- ✓ Water Programs
- ✓ Participatory environmental monitoring of air, soil and water quality with local communities



www.tahoeresources.com

Dear Reader,

The months leading to Peru's 2016 presidential election gave a feeling of deceleration, yet they were actually quite eventful. Quietly but steadily, two of the world's largest copper mines, the expanded Cerro Verde and Las Bambas, located in the south of the country, ramped up output to dramatically increase the red metal production profile of Peru.

GDP growth over 3% in 2015 was probably not outstanding, but it showed the resilience of the Peruvian economy during a period where many investment groups decided it was time to be cautious, or even pessimistic, for a combination of global and local factors.

Truly, the slowdown in new mining and infrastructure projects was not easy to digest for contractors and suppliers that had grown explosively during the previous years, but there are always two sides to a coin: companies were forced to sharpen up, become more efficient and add more productivity and value to their clients.

The crisis has also pushed players to broaden their perspective. In the same way that European infrastructure groups have gone global to offset the decline of business in the Old Continent, Peruvian mining contractors and suppliers have an outstanding opportunity to take their expertise beyond Peru's borders. The immediate neighbors and the countries of the Pacific Alliance are the natural destinations to be tapped first.

While analysts have modest growth projections about copper prices for the short term, the positive performance of precious metals and other base metals like zinc during the first half of 2016 should give a new boost to the industry, especially now that a new administration with an investment-friendly strategy is in place.

In this context, we are delighted to present 'Industry Explorations - Peru Mining 2016', a comprehensive review of the latest developments in Peru's mining industry, and a complete guide of players across the whole value chain. This year's edition is in English, to respond to the increasing demand for information about Peru in the international markets.

This book has been produced after a thorough process of research and face-to-face interviews with the main industry leaders. If you are one of those, we would like to thank you for your participation. We hope you enjoy the read.



Alfonso Tejerina
Senior Project Director
Global Business Reports

Mining producers

Analysis on the latest production trends and interviews with the main players in both precious and base metals.

18-41



Service providers

From engineering and construction to drilling and blasting specialists.

58-83 and 114-139



This research has been conducted by
Alfonso Tejerina, Laura Brangwin,
Katherina Prügel and Miguel Pérez-Solero

Edited by Mungo Smith and Alfonso Tejerina
Graphic design by Designa

A Global Business Reports Publication
For updated industry news from our
on-the-ground teams around the world,
please visit our website at gbreports.com,
subscribe to our newsletter by signing up
to our VIP list through our website,
or follow us on Twitter: @GBReports

Peru Mining 2016
Industry Explorations
Global Business Reports



Exploration

A summary of the main projects in the pipeline for the foreseeable future.

42-57



Equipment and technology

Read the latest developments from the world's largest mining technology companies.

84-113

An Introduction to Mining in Peru

- 8. A new government takes the helm
- 10. Interview with SNMPE
- 11. Interview with 3rd International Mine Management Congress
- 14. Community relations at the forefront
- 16. Interview with Minsur
- 16. Interview with Alva Hart Consultores
- 17. Interview with Viceversa Consulting

Mining Production

- 20. Precious metals
- 22. Interview with Barrick Gold
- 23. Interview with Tahoe Resources
- 24. Interview with Consorcio Minero Horizonte
- 25. Interview with Compañía Minera Poderosa
- 26. Peru's main mines
- 28. Interview with Hochschild Mining
- 29. Interview with Pan American Silver
- 30. Large copper producers
- 32. Interview with MMG Las Bambas
- 33. Interview with Freeport-McMoRan
- 34. Interview with Hudbay Minerals
- 36. Base metals
- 38. Interview with Milpo
- 39. Interview with Minsur
- 40. Interview with Sierra Metals
- 41. Interview with Southern Peaks Mining

Project Development and Exploration

- 44. Feeding the project pipeline
- 45. Gold-focused juniors
- 46. Interview with Dynacor Gold
- 47. Interview with Lupaka Gold
- 49. Interview with Eloro Resources
- 50. Interview with Bear Creek Mining
- 51. Base metals exploration
- 52. Interview with AQM Copper
- 53. Interview with Regulus Resources
- 54. Interview with Tinka Resources
- 55. Phosphate potential
- 56. Interview with Focus Ventures
- 57. Interview with Cementos Pacasmayo

Engineering and Construction

- 60. Engineering
- 62. Interview with Hatch
- 63. Interview with SRK Consulting
- 64. Interview with BISA
- 64. Interview with EPCM Experts
- 65. Interview with Mining Plus
- 66. Interview with JRI
- 67. The environment
- 68. Interview with Golder Associates
- 68. Interview with MWH Global
- 69. Interview with Klohn Crippen Berger
- 71. Construction
- 72. Interview with OHL
- 74. Interview with STRACON GyM
- 75. Interview with HV Contratistas
- 76. Construction ancillary services
- 77. Interview with Maccaferri
- 77. Interview with Tierra Armada
- 78. Interview with Layher
- 78. Interview with Esmetal
- 79. Interview with Vivargo
- 81. Underground contractors
- 82. Interview with Robocon
- 83. Interview with TUMI

Equipment and Technology

- 86. Equipment providers
- 87. Interview with Ferreycorp
- 88. Interview with Komatsu M.M.P.
- 90. Interview with Joy Global
- 90. Interview with Liebherr
- 91. Interview with Atlas Copco
- 92. Interview with Sandvik
- 92. Interview with Boart Longyear
- 93. Components and spares
- 94. Interview with Austin Engineering
- 95. Interview with Esco
- 95. Interview with Bosch Rexroth
- 96. Ancillary Equipment
- 97. Interview with Volvo
- 98. Underground equipment
- 99. Interview with Normet

- 100. Interview with Resemin
- 101. Plant solutions
- 102. Interview with Moly-Cop
- 104. Interview with Outotec
- 105. Automation and energy efficiency
- 106. Interview with Siemens
- 107. Interview with Eaton
- 108. Interview with Emerson
- 110. Productivity and environmental solutions
- 111. Interview with Quimtia
- 112. Interview with Veolia
- 113. Interview with Xylem

Mining services

- 116. Drilling
- 117. Interview with AK Drilling Int.
- 118. Interview with Explomin
- 119. Interview with Geotec
- 120. Laboratories
- 121. Interview with Certimin
- 122. Interview with SGS
- 123. Blasting solutions
- 124. Interview with Exsa
- 125. Interview with Orica
- 127. Legal issues and risk prevention
- 128. Outsourcing services to specialists
- 130. Interview with AVIS
- 131. Interview with Adecco
- 132. Power generation
- 132. Interview with Siemens
- 133. Transportation and logistics
- 134. Interview with PeruRail
- 134. Interview with Transportadora Callao
- 135. Interview with MIQ Logistics
- 135. Interview with Stiglich
- 136. Mining safety
- 137. Interview with ISEM
- 137. Interview with Vertisub Group
- 138. Interview with 3M
- 139. Interview with DSI

- 140. Company index
- 142. Credits





AN INTRODUCTION TO MINING IN *PERU*



“If you compare Peru and Chile, the international prices have been exactly the same for both countries. The difference is that in Chile, people are aware that copper is their bread and butter, even Salvador Allende said it. Chile is a mining country, while Peru is just a country with mines. To be a mining country, we need to share a conviction that mining is the biggest strength on which we can cement our development.”

- Carlos Gálvez,
President,
SNMPE

Image: Hudbay Minerals

Peru: A New Government Takes the Helm

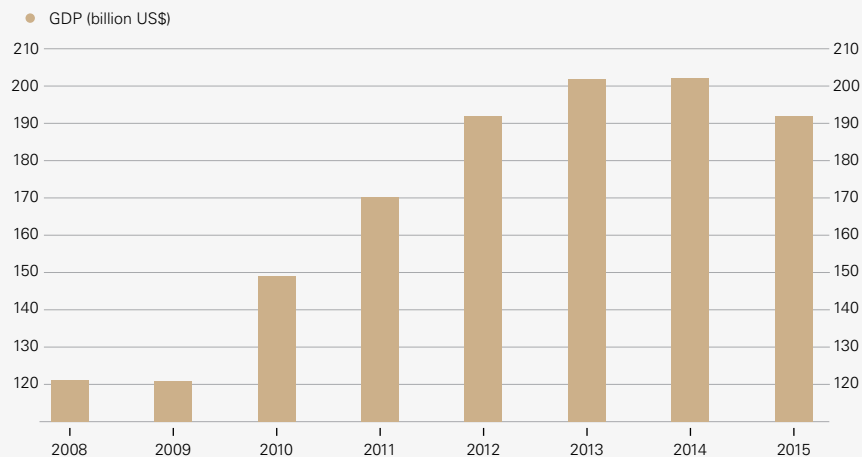
The election of a proactive, business-friendly president should give new impulse to mining project development once metal prices are back

The Ollanta Humala administration has drawn to a close. The election of Pedro Pablo Kuczynski as the country's president, popularly known as PPK, has created fresh optimism within the business community in Peru. Many in the mining industry blame Humala for inaction when the country needed new projects to keep pushing GDP growth. After all, the Conga and Tía María projects are still on hold.

The outgoing administration, however, is not satisfied with this negative perception and presents a different picture: between 2011 and 2015, total mining investments in the country reached a record \$42 billion. It is true that while the government did not want to side with mining companies for the most conflictual projects, it did not act as an obstacle to other large ventures either. Peru is unlikely to maintain its GDP growth levels without fresh investment in the mining sector. After a disappointing 2.35% expansion in 2014, growth levels reached 3.26% in 2015. This was mainly a result of the commissioning of two enormous copper projects: the expansion of Freeport McMoRan's Cerro Verde to 360,000 metric tons of throughput per day (mt/d), and the commencement of operations of Las Bambas, operated by Australian-Sino company MMG.

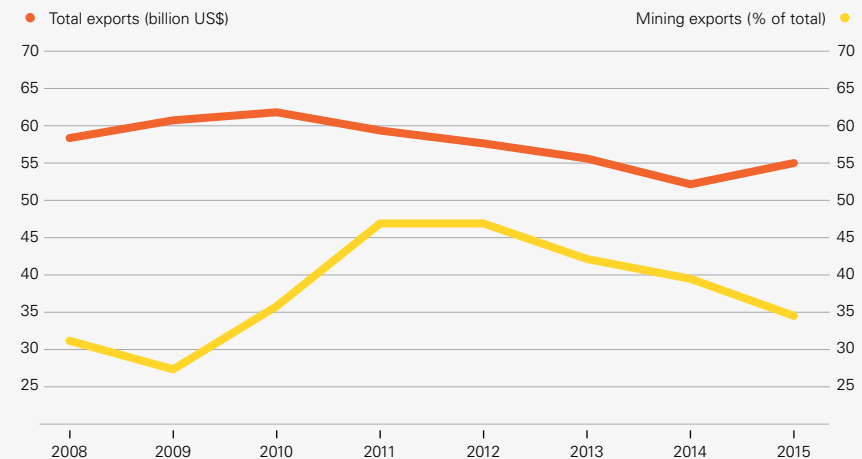
GDP EVOLUTION IN US DOLLAR VALUE

Source: IMF



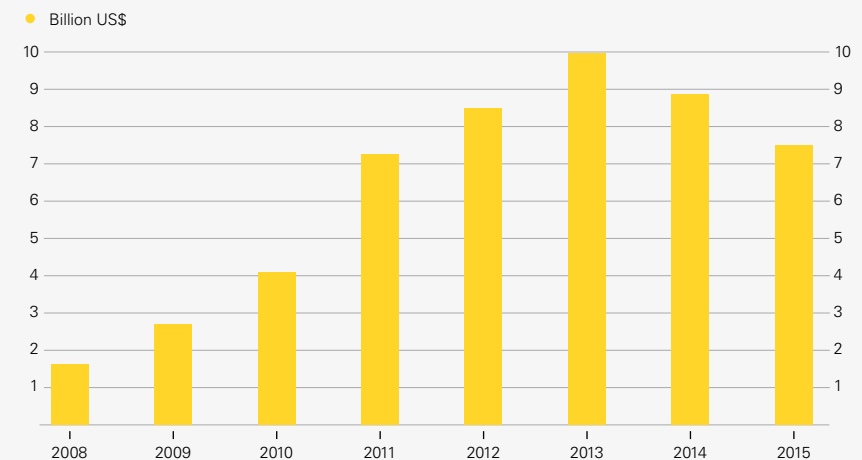
ANNUAL EXPORTS BY VALUE

Source: BCRP



TOTAL MINING INVESTMENTS IN PERU

Source: MEM



PERU AT A GLANCE

Source: IMF

Capital City: Lima
GDP: \$192.1 billion
GDP Growth (2015): 3.26%
Head of State: President Pedro Pablo Kuczynski
Current Account Balance (% of GDP): -4.4%
Inflation Rate: 3.5%

DEMOGRAPHIC DATA (2015)

Sources: IMF, INEI

\$6,021

GDP per capita

\$12,195

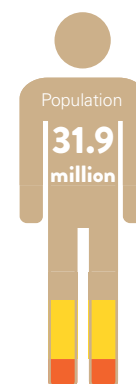
GDP per capita (PPP)

21.8%

poverty rate

6%

unemployment rate



Looking at the latest figures, copper production jumped from 1.3 million mt/y in 2014, to 1.7 million mt/y last year, with expectations to reach 2.3 million mt/y in 2016, as the latest new ventures reach full capacity. After three years of decline, gold production went up last year, reaching 4.66 million troy ounces per year (oz/y); silver production rose and reached 131.9 million oz/y. Zinc (+7.7%), lead (+13.4%) and molybdenum (+18.1%) also recorded positive growth figures. Only tin (-15.5%) and iron (-12.3%) performed worse in terms of volumes as compared to 2014.

The question now is 'what's next?' 2016 may see the expansion of Southern Copper's Toquepala operation as the only sizeable capital endeavor. Other large copper projects in the pipeline, like Anglo American's Quellaveco, Rio Tinto's La Granja, China Minmetals' El Galeno or First Quantum's Haquira, will still require some time to come online, provided positive investment decisions are triggered and the respective social licenses are obtained.

The fact that these projects have been in the Ministry's pipeline for years frustrates industry leaders because they are yet to translate into real production and real value for the country. In other words, the indus-

CREATING VALUE FOR OUR COUNTRY AND ITS PEOPLE

At Milpo, we are committed to creating value in Peru by mining with social responsibility, focused on protecting the environment, developing human capabilities and seeking technically innovative solutions in our mining operations and projects compatible with the development of neighboring communities.


www.milpo.com


Company part of: **Votorantim**
Metais

Carlos Gálvez

President
SNMPE

What have been the main milestones for Peru's mining industry over the last months?

The main milestones have been the production at full capacity at Toromocho and Constancia; the expansion of Cerro Verde, which has been very successful; and the completion of Las Bambas. The latter two projects have changed our position as a copper producer worldwide. Global copper output is about 19 million mt/y; Peru contributed 1.7 million last year, and this year we should have a production of 2.3 million mt. This way we overtake China as the world's second largest producer.

How could Peru take advantage of these developments?

It is a shame that we did not take the decision four or five years ago to export electricity to Chile. Both Peru and Chile could now be reaping the benefits of that. Looking at the wider picture, we need to develop the ancillary services: equipment, supplies and the relevant technologies. Unfortunately, the public still sees us as an industry that just exports 'rocks', but there is a whole technological development behind it that can provide many applications in other segments. At the SNMPE we have worked with CONCYTEC on several projects. IT experts from Buenaventura, for instance, developed systems to detect mining operators' fatigue, monitoring eye-blinking. This technology can be applied to transportation companies and also to particular vehicles, to increase safety. Another company developed a sub-aquatic system to permanently monitor the quality of water. This can also be used in the marine sector, to detect illegal fishing activities.

With lower metal prices, politicians find it easier to underestimate the importance of mining for Peru. What do you think of this?

In the 45 years I have been involved in the mining industry, I have seen many cycles. Overall, you have more years of crisis than years of bonanza. If you compare Peru and Chile, the international prices have been exactly the same for both countries. 50 years ago, copper production in Chile was just a bit higher than Peru's. However, today, Chile produces 5.9 million mt/y, while we only produced 1.7 million last year. The difference is that in Chile

people are aware that copper is their bread and butter, even Salvador Allende said it. Chile is a mining country, while Peru is just a country with mines. To be a mining country, we need to share a conviction that mining is the biggest strength on which we can cement our development.

How do you expect gold prices to behave in 2016?

Mineral prices are rebounding, especially gold. Investors are seeing that the economies are not growing at the expected level; that currencies are not as strong as they thought; that interest rates are not high and could even become negative interest rates. In today's risky environment, not only China and India, but also the Muslim world, will demand more gold. On the other side of the equation, we have less and less discoveries, exploration is more difficult worldwide, heap leaching technology cannot go any further to exploit low-grade deposits, and the environmental and social restrictions are increasing. Even though gold prices reached levels of \$1,900 per ounce, gold production has remained flat and the industry has been unable to replace reserves. In one more year, I expect gold to be worth \$1,400 per ounce.

What do you think of tax stability agreements?

When you sign a tax stability agreement, you take a picture of the tax rules in that particular moment and commit to pay an extra as an insurance policy against future changes. This is perfectly valid for long-term projects like mining projects. Clear rules of the game is the minimum investors can ask for in a multi-billion project that has many other risks: geological risks, operational risks, market risks. A company like Cerro Verde pays 30% income tax and a 2% surcharge for the stability agreement, as well as the other related royalties and taxes. Now that income tax has gone down to 28%, Cerro Verde still pays 32%. Meanwhile, the tax on dividends is going up from 4.1% to 6%, and shareholders are affected by that increase, because shareholders are not covered by the tax stability agreement.

What should be the key priorities of the new government?

The new government should expand its footprint. If you look at the areas with the highest human development indexes, these correspond to the areas where the State has a bigger presence. But if you look at the areas where we have natural resources, it is exactly there where the State is not present. Tax money is always spent in Lima, where most of the voters are. Peru has produced oil for half a century, yet, in the jungle, close to the oil operations, there is no water, there is no sanitation, there is no justice, there is no security, there is not health coverage. We have a structural problem. —

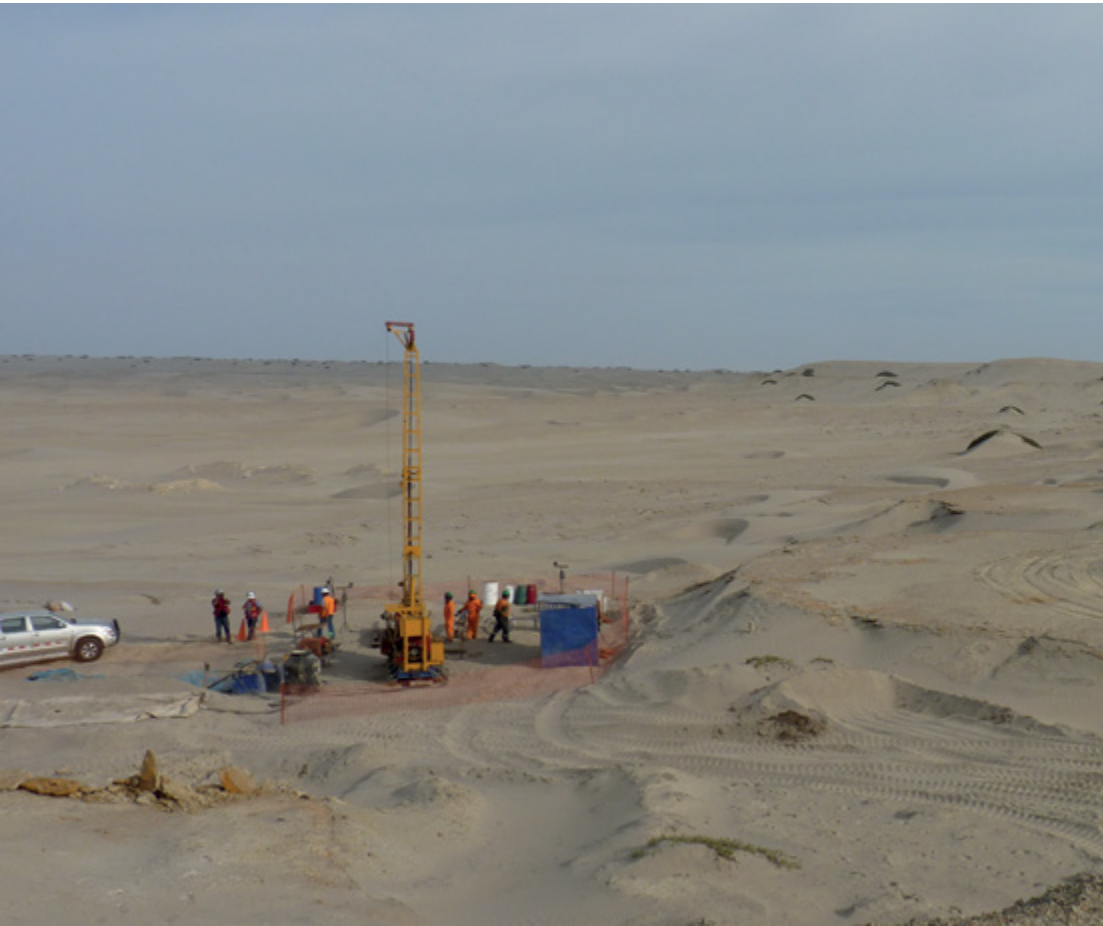


Image: Focus Ventures



Rodrigo Prialé

President
3RD INTERNATIONAL MINE
MANAGEMENT CONGRESS

How have management strategies changed in the mining industry?

In the 1990s, the industry was more fragmented, therefore the operations were smaller and, by and large, they were run by mining engineers, geologists and the like, with a focus on operational aspects. As the industry consolidated and bigger players emerged, companies started to focus more on management strategies. It was not just about producing minerals at low costs, but also about planning capital expenditures efficiently.

Experienced mining managers are scarce in Peru. Why is this?

The young generation of mining engineers entered the market during bonanza years, so they do not have experience running operations in low-cycle situations. Besides this, in the particular case of Peru, the industry was not attractive for professionals in the past when the State was the main operator and the Peruvian economy faced serious economic crises and terror-

ism problems. Becoming a mining engineer was even dangerous. All these issues created a gap in the formation of mining professionals.

How can Peru, as a country, develop a long-term agenda for mining development?

If you look at the main mining countries, like Australia, Chile, Canada and the U.S., you observe that they all plan their mining development with a long-term vision for the industry. In Peru, unfortunately, we tend to plan with a short time perspective; in some cases we have five-year projections, depending on the government. However, mining projects take more than one administration to come to the production stage. Las Bambas, for instance, took nearly a decade to start operations.

What can mining companies do to mitigate commodity price risk?

The nature of the extractive industries makes it impossible to avoid certain imbal-

ances between supply and demand, at least during some periods. For instance, when Xstrata was advancing Las Bambas, about eight years ago, it had an idea of the potential of the deposit, but was not able to plan very precisely when its production would reach the market. If, instead of five years, for different reasons it takes eight years to be commissioned, it may happen that the new output, 400,000 mt/y of fine copper in the case of Las Bambas, will actually reach the market in parallel with other new projects, and when copper demand has slowed down. Therefore, there is now a copper surplus in the market, and the company has invested billions of dollars and cannot just stop producing its 400,000 mt/y. The only way the mining industry could avoid these imbalances would be for companies to voluntarily reduce production. Now, as prices are low, there will not be many new projects coming up soon, while demand will continue growing; so prices will increase again. While that happens, mining companies need to be more efficient. —



Image: Cerro Verde

try has done well, but could have done so much better. Ernesto Balarezo, until recently VP Americas at Gold Fields, lamented that no new project was added to the pipeline during the 2011-2016 Humala administration. "All the projects that started production recently, such as Las Bambas, Inmaculada or the expansion of Cerro Verde, come from the previous government. What we have seen is the exact opposite: projects being put on hold. If we have five more years of drought, this will result in an overall delay of 15-20 years before new mines come into production. It is an emergency for Peru's mining industry."

Carlos Gálvez, president of the National Society of Mining, Petroleum and Energy (SNMPE), the main industry association,

looks south and explains that Peru has a lot to learn from Chile in terms of its long-term plans and policies: "The international prices have been exactly the same for Peru and Chile. The difference is that in Chile, people are aware that copper is their bread and butter. Chile is a mining country, while Peru is a country with mines. To be a mining country, we need to share a conviction that mining is our biggest strength." Despite these challenges, many in the sector are optimistic. Mariela García de Fabbri, CEO of Ferreycorp, a large holding whose main business is the Caterpillar representation in Peru, expects mining to continue being the backbone of the economy: "In 2015 and 2016, the rhythm of mining investments has slowed down, yet we strongly believe that mining is here to stay,

at least for the medium term. The portfolio of mining projects is worth \$60 billion. In 12 to 18 months, with just one or two announcements for new large projects, we will be again in a great growth position." Kuczynski will now have to prove to be decisive enough to tackle potential social unrest and promote new investment. Whether he can unlock Conga and Tía María or not remains a big question mark, but a recovery of metal prices would entice investors to pour money into other projects. In the meantime, increased copper production during the year will have a positive impact in Peru's GDP growth figures, supporting the argument that if Peru is to diversify its economy, it needs to do so without turning its back on its main driver: the mining industry. —

SIEMENS
Ingenio para la vida

Cuando la tecnología ayuda a las personas a construir su futuro, dejando así un legado duradero. Eso es Ingenio para la vida.

Cuando la generación y suministro de energía confiable hace sentir a todos como en casa. Cuando los recursos más preciados de una nación alimentan a las próximas generaciones de innovadores. Cuando los procesos de fabricación eficientes ayudan a las personas a vivir la vida que ellos quieren y las soluciones eficientes de movilidad aseguran que las personas estén ahí para los momentos más importantes. En toda la región, Siemens está ayudando a poner la visión en acción. Eso es Ingenio para la vida.

siemens.com.pe

CGCB-A10146-00-7800

Community Relations at the Forefront

New project development cannot happen without the social license

The issue of social conflicts related to the mining sector is nothing new. While the press typically focuses on high-profile cases, like the awarding earlier this year of the Goldman Environmental Prize to Máxima Acuña, a farmer in litigation with Yanacocha over a plot of land, there are many disputes that people in Lima never hear of, unless violence and clashes erupt.

According to Peru's Ombudsman Office, which publishes every month a snapshot of social conflicts, in March 2016 there were 208 conflicts in the country. Of these, 146 had to do with socio-environmental issues, and within this group, mining-related disputes accounted for 93 of them.

Among the factors explaining these conflicts we may find past environmental mistakes by the industry, low profile communication policies, hidden political agendas by anti-mining activists, the absence of State representatives in rural areas, and the incompetence (or even corruption) of authorities to invest the tax money in sustainable projects.

Each conflict should be analyzed on a case-by-case basis, avoiding simplistic generalizations. Yet both the central government and the industry should reflect on what needs to change at a macro level as well. It is shocking that modern, formal mining operations in Peru have been developing for more than two decades in the country, yet in the past presidential poll Gregorio Santos, an outspoken anti-mining activist who happened to be in

jail, managed to get 40% of the vote in the Cajamarca region. Social unrest does exist, and it needs to be addressed.

What Mining Companies Can Do

Social conflicts in the mining and energy industries are not exclusive of Peru. Cases of disputes can also be seen in Chile, Australia or Canada. Peru, however, presents its own particularities due to the striking inequality levels between the coastal regions and the Andean areas, where most of the mines are. The mining industry is right to argue that it is already the largest contributor of income tax money to the State's coffers, and that it should not be its responsibility to build roads, hospitals and schools. The unsettled reality, however, is stubborn, and change is not happening as fast as it should. In this context, mining companies have learnt that they actually have a lot to lose if they do not go the extra mile when it comes to corporate social responsibility initiatives.

Beyond compliance with the already strict environmental and social regulations, the opportunities to improve local living standards are multifold, and go from healthcare and education, all the way to improving pastures and helping local businesses. All this, however, should be done in coordination with authorities at all levels, ensuring that the mining company is not seen as a piggy bank but as another neighbor in the community, who contributes with taxes, lo-



Image: Bear Creek Mining

cal employment and with expertise in project development.

Canadian company Bear Creek Mining was stripped off its license for the Santa Ana project back in 2010 after a general strike ended in violence. Since then, the company has been trying to get damages from the Peruvian government through an arbitration process, but it has also been actively working on its social license for the larger Corani silver project in Puno, a \$600-million capital project.

Elsario Antúnez, COO of Bear Creek, gave more details on the company's social projects: "For the last years, we have been working on three main pillars: education, health, and sustainable productivity. Back when we started in 2007, education levels were extremely poor; probably only 5% of the people could read and write. Now, the local Chacacónisa and Quelccaya schools have received educational quality awards for three consecutive years from the Puno region."

"In terms of health, we helped reduce newborn mortality rates from 30% in 2010 to less than 5% today. Finally, we have worked on alpaca wool projects, improving the quality of the wool and helping producers export directly to Europe instead of selling locally to traders. Before, they were paid \$4 per pound of wool, and now they can sell for \$70 to \$100 per pound," Antúnez explained.

In May 2015, the Peruvian government announced a \$20 million investment program in infrastructure in the Corani district. Antúnez said that Bear Creek was instrumental to act as a bridge between the local community and the State authorities, in order to unlock sanitation and housing projects in the area.

The Water Issue

Corani's latest feasibility study incorporates a very interesting concept that is fairly new for large volume operations: the use of dry stack tailings, which means the mine will not have a tailings dam. Andrew Swarthout, president and CEO of Bear Creek, assures that water was never an issue at Corani, yet this technological innovation "can reduce the environmental impact of Corani even further."

Leaving aside the potential risks of tailings dams management, the use of water itself is

a recurrent source of disputes between mining companies and rural people in the surrounding area. The conflicts over Conga, where the construction of alternative reservoirs failed to convince the local communities, or over Tía María in the fertile Tambo valley in Arequipa, are cases in point.

The industry, however, has proven that it can successfully implement initiatives that create synergies in water usage. Milpo was a visionary company in this respect, when it implemented the country's first desalination plant at Cerro Lindo in 2008. Today, Cerro Lindo is the company's flagship operation, and is expanding yet again to reach 20,000 mt/d of processing capacity.

In the south, Cerro Verde realized that, at the same time that it assured the supply of water required for its expanded operation, it could help the city of Arequipa, as most of the raw sewage was going directly into the river. So, it built a brand new treatment plant to clean up the water and take one cubic meter per second for its own process.

"One of the big upsides of the project is that, because of the quality of the water that farmers downstream were getting before, they could not meet the export standards for produce. Now, with the improved quality, they have a wider choice in terms of what they can produce," said Harry Conger, president and COO Americas and Africa Mining at Freeport-McMoRan.

Bruce Clements, president of Cerro Verde, further developed on this: "Farmers in Arequipa use approximately 71% of the available river water. We use another 10%, and the city, the remaining 19%. There is more water than people believe there is. Many farmers are using flood irrigation systems that are not efficient. By increasing efficiency, they could expand their cultivable land. We can certainly help them in this process."

Mining is a central activity for Peru and it plays a key role in its economic and social development. Arequipa, for instance, is seeing remarkable growth, thanks to Cerro Verde and the pool of providers that are investing in plants and service shops in the region. The challenge will be to replicate that across the whole Andean region. In this context the industry, the authorities and the communities should all work together to ensure that mining continues to develop in a sustainable manner, respecting the environment and helping reduce income inequality. —



Gonzalo Quijandría

Corporate Affairs Director
MINSUR

tives. The problem is that the process is seen by many as an opportunity to veto projects, and this is not the case.

How do multi-actor mechanisms work?
Multi-actor spaces should be a widespread practice around the country. This has probably been the best heritage of the Humala administration and comes from the need to bring the State authorities right to the areas where they receive a big chunk of tax revenues; so right by the mines. The State needs to come with all its actors, not just the Ministry of Energy and Mines, but also Health, Education, Housing, Justice, etc. This needs to be implemented at the beginning of projects, before any conflicts may come up. Other positive results of this collaboration are a better management of tax revenues and the increased awareness among civil servants of the importance of these mining projects.

Do you think the voluntary contribution program should be reinstated?
The voluntary contribution program worked well 10 years ago, at a time when the authorities were unable to efficiently spend the money from the mining canon. Today, processes are still slow on the government side, but there are alternatives to voluntary contribution, such as the *Works for Taxes* program or other types of public-private partnerships.

What are the main 'mining myths' to be deconstructed?
One of them is that mining is not very important for the Peruvian economy. We saw a clear example when we ended 2015 surprisingly well in terms of GDP growth thanks to Cerro Verde and Las Bambas. Some people argue that the core of the Peruvian economy is services and trade, but why do we have all those services? The mining industry creates nine indirect jobs for every direct job. Water is another myth. Peru is one of the countries with the highest water availability and the mining industry has successfully implemented initiatives to transfer water resources to desert areas. Finally, another myth is that mining affects people's health. If you do things right, there will not be any health issues. After many years discussing about the animals that died around Tintaya, the government has stated that it was the bad quality of pastures and the presence of parasites that killed the animals, not anything to do with the mine. —



Beatriz Alva Hart

General Manager
ALVA HART CONSULTORES

How did Alva Hart Consultores start to work in mining?
We worked with Cerro Verde during the first expansion of their primary sulfides plant, auditing all of their contractors. I realized that it was very different to do an audit from the office than to actually be on site, and this is how we grew in this service. For Buenaventura, for instance, we audit their contractors at all their sites. Besides the common corporate policies, each mine has its own personality depending on who the manager is, so, all this enriches our work. Today, we offer a multi-disciplinary service. It is not just legal advice, but also covers the operational processes. We have lawyers, engineers, accountants, psychologists, anthropologists and sociologists working on the different projects. With all this experience, we are able to identify the social problems related to employment and this is how we start a program for local employment, with a thorough study of the population around the projects.

What are the pros and cons of creating communal companies to contract with the mines?
Although communal companies do not have to pay income tax, the legislation presents some challenges. When you propose the cre-

ation of a communal company, some families in the community may be afraid of losing out. Then, everyone wants to participate, but not everyone has civil authority to do so. In these communities, some people have problems with their civil status, and this is where you realize that the laws are not adapted to the reality of these people.

Can the efforts from mining companies to renegotiate contracts with suppliers harm the relationship with the local communities?
If miners go too hard on their contractors in terms of their cost-reduction efforts, the contractors will just replace people earning 10 with people earning 6. Of course, the final quality of the service will not be the same. You may also incur in safety and operational risks, which may result in the mining company taking over the operation. In the past, Sunafil has already forced a mining company to incorporate all the workers from that contractor as permanent staff.

The years of high prices left the controversy of the profit-sharing model not applying to contractors. Is the law going to change?
There are several projects in Congress to extend the profit-sharing scheme to mining contractors. For the mining company, nothing would change, as the percentage would remain at 8%. The portions would just be smaller for each of the workers, and those working for mining companies obviously do not want that to happen. What is happening today is that large mining companies give a bonus to contractors in the good years, but it is not easy to handle this because the contractors give that away to their workers as extraordinary remuneration to avoid paying the labor fees involved, but you can only do that for two years. After this period, legal issues arise.

What is the main ingredient for sound community relations?
Respect, knowledge and communication are the key. Very often they ask me about what the ideal profile is for a professional in community relations. There is not a particular degree; whether the person is a doctor or an engineer, that is not what matters. What matters is that the person has social sensitivity. All the professionals involved in the operation need to work with a lot of respect. If you announce you are going to do something, you need to do it. Otherwise, trust cannot be built. —



Álex Sánchez

CEO
VICEVERSA CONSULTING

What are the main lines of work of Viceversa Consulting?
Viceversa Consulting was established in 2000 with a clear vision to integrate environmental, social, health and safety and communication services. We took that approach following Peru's subscription of the ILO's Convention 169 in 1993. What happens still today is that you have consultancy companies that specialize in just one niche. We are very happy that today our vision has become the State's standard. On December 28th, 2015, the National Service for Environmental Certification (Senace) started to operate as the new single window to process all environmental impact assessments (EIAs). As a requirement, Senace demands that the companies producing the EIA have multi-disciplinary teams with engineers, sociologists and communication officers. This is exactly what we have in Viceversa since 2000.

What can the world learn from the experiences that Peruvian investment projects have had in social relationships?
Peruvian professionals are in high demand for the development of mining projects in

countries where mining is an emerging activity, like Colombia, Ecuador or Argentina. Even Chile is learning from the Peruvian experience. In northern Chile there are no community issues because the mines are in the desert, but the new projects in central and southern Chile are likely to need significant community relations programs.

How important are company reputation and the perceived country risk for project development?
Mining projects are not paid for by cash flow. They require financing: as an example, Glencore's takeover of Xstrata required the participation of 17 banks. In that respect, country risk is key in terms of obtaining access to finance, and one of the challenges for Pedro Pablo Kuczynski is going to be improving Peru's global perception of high social risk. From our perspective, this is achieved through prevention. We always tell miners that they should not wait until they have an infection, because then they will need an operation. An operation costs more money and leaves scars. Therefore, it is better to have a vaccine. Having a consultant like us do a thorough study of potential social issues in the project costs nothing if you compare it to the money you are going to make if you have a successful project. As an example, in 2006, Peru Copper invested \$2 million to acquire Toromocho, and invested \$20 million in the project. They hired Viceversa Consulting to help them manage the relocation process at Morococha. With our help, 98% of the population voted in favor of relocation. This was a pre-requisite to get the green light from the authorities. With this, Peru Copper went to the market and sold the project to Chinalco for \$870 million. This is one of the key messages we want to convey: reducing social risk can be very profitable.

Why do some mining companies run into social trouble when they are spending millions of dollars in social projects?
I think that the main problem is that projects are often imposed from top to bottom, and not the other way round. Without imposing projects, you can guide the communities to make sure that these projects will add value for them, and that they will be happy. —



MINING PRODUCTION



“Gold production increased in 2015, which is good news because it was suffering from a declining trend in previous years. Silver production also increased. In copper, we are the second-largest producer worldwide with the new production from Cerro Verde and Las Bambas. This copper output also includes gold and silver, so the decline at Yanacocha this year should be mitigated with gold by-products in copper operations.”

- José Miguel Morales Dasso,
Partner,
García Sayán Abogados

Image: Las Bambas (MMG)

Precious Metals

Peru's competitive cost position helps generate free cash flow, the mining producers' new mantra

Peru not only has one of the largest mining industries worldwide in terms of production, it is also one of the most profitable jurisdictions for those companies that were successful in project development. Looking at the international gold producers, their all-in-sustaining-cost (AISC) position in Peru outperforms their global averages. Barrick's Lagunas Norte operation produced at an AISC of \$509/oz in 2015, far below the company's \$831/oz average. Gold Fields' Cerro Corona gold and copper operation yielded costs of \$700/oz of gold equivalent, while the company's average is \$1,026/oz. With the gold price at stable levels in the \$1,200-1,300/oz range, any mine with costs below \$1,000/oz not only has a healthy margin, but also is in an enviable position to capitalize on the next bullish rally. "Today, it is not about producing more for the sake of producing more. It is about producing in a profitable manner, maximizing free cash flow," said Manuel Fumagalli, executive director of Barrick in Peru. Lagunas Norte, one of the corporation's core assets, produced 560,000 oz of gold in 2015. Output in 2016 should be 410,000 to 450,000 oz of gold, at AISC of \$570 to \$640. The increase in costs is partly explained by the capital expenditures to expand the Phase 6 of the leach pad. Moving forward, Barrick is working hard on extending the mine's life. As part of the refractory ore project (PMR in Spanish), the pre-feasibility study of which was completed in 2015, gold reserves have in-

creased to 3.7 million oz. The project is now entering feasibility to try to reduce the estimated \$640 million capital expenditure and it could see production by 2021. A growing player in Peru's gold spectrum is Tahoe Resources, a medium-sized producer that has significantly raised its profile through the acquisitions of Rio Alto Mining and, more recently, Lake Shore Gold in Canada. The company's two assets in Peru are La Arena, which produced 230,000 oz of gold in 2015, and Shahuindo, a project in Cajamarca that is reaching commercial production this year. Tahoe's VP of operations Tim Williams gave some insights about the progress at Shahuindo: "Construction started last year and the start-up pad with a capacity of 4.5 million metric tons (mt) has been completed for the current 10,000 mt/d mine plan. One difference with the La Arena process is that Shahuindo recoveries will greatly benefit from crushing and agglomeration. Shahuindo is expected to operate at 36,000 mt/d as of 2018." South African company Gold Fields is also looking at how to extend its Cerro Corona operation beyond 2028, when the reserves will be exhausted, but the mine is space-constrained and the Cajamarca region is very challenging from a social perspective. In 2015, production was around 300,000 oz/y of gold equivalent (159,000 oz of gold and 28,700 mt of copper). The operation was cash flow-positive despite lower copper prices in 2015, and the company continues to push for more operational ef-



iciency. While the main sources of capital expenditure are the tailings dam and the waste storage deposits, Ernesto Balarezo, until recently VP Americas at Gold Fields, insisted that creativity will be the main recipe for success: "In Cerro Corona we have not laid off a single person to reduce costs. We are renegotiating contracts with suppliers, while we are picking everyone's brain in the organization on how we can make things better. Last year, we successfully implemented five operational initiatives, the most significant one being the 'sandwich project', which consists of uniformly blending the ore before going to the primary crusher." To respond to depressed silver prices, Hochschild Mining, an important precious metals producer, has undertaken an impressive cost reduction effort over the last years. In 2012, AISC per oz of silver equivalent was \$21.7. In 2015 it was just \$12.9, a 41% decrease over three years, and a 26% decrease if compared to 2014. The main causes behind the 2014-2015 cost reduction are actually talent-driven. One is the commissioning of Inmaculada, a gold and silver mine that is expected to contribute 14 of the 32 million oz (Ag eq) the company plans to produce this year. The second factor consists of rising grades (a result of smarter exploration) and operational efficiencies. Realizing more competitive costs, coupled with larger production volumes, is also the strategy of medium-sized gold producers with underground assets, such as Horizonte and Poderosa. The former operates the Parcoy mine, with a processing capacity of 2,000 mt/d, which yielded 252,000 oz of gold in 2015. Meanwhile, output from Poderosa was 190,000 oz of gold last year (+22%), and estimates for 2016 are 205,000 oz, with a medium-term goal to reach 230,000 oz/y. Current processing capacity for the operation, located in the gold-rich Pataz batholith, is 600 mt/d. Poderosa's general manager Marcelo Santillana explained that, on top of the efforts of miners to reduce costs, market prices of supplies went back to more reasonable levels after the inflation of the boom years: "In 2015, we had more favorable prices of cyanide, steel, wood and fuel. Cyanide, for instance, went down from \$3 to just \$1 per kilogram." This situation may be reversed though, with gold prices seeing an upward trend again. —





Manuel Fumagalli

Executive Director
BARRICK PERU

“

One of the biggest challenges is managing the escalation of social conflicts. The government needs to have a stronger presence in the remote areas and provide basic services and development opportunities to ensure that the expectations and needs of the local people are fulfilled.

”

Where does Barrick stand today?

Barrick has a streamlined business model maximizing free cash flow, a strengthened balance sheet and is focused on its best gold assets. As part of taking Barrick 'back to the future', we are returning to the original culture of the company: more entrepreneurial, more flexible and with a decentralized operating model. A Growth Committee has been created just recently within the organization. We want to make the most out of our assets, while exploration is also essential, both brownfield and greenfield. We are also looking at opportunities to acquire mining rights from third parties. Right now, Barrick has the largest gold reserves in the industry. The idea is to maintain financial discipline and assess individual projects against our return on invested capital hurdle rate of 15%. If you want to reduce costs, you need to focus on the best assets and implement best in class practice. Today, it is not about producing more for the sake of producing more. It is about producing in a profitable manner and maximizing free cash flow. As an example of Barrick’s renewal focus, in 2015 we reduced our debt by \$3.1 billion, in part through the sale of non-core assets, and lowered AISC from \$864 to \$831/oz.

Lagunas Norte is one of Barrick's key assets. What are the latest developments there?

Last year we conducted a pre-feasibility study (PFS) for the refractory ore project (PMR in Spanish). As part of that, we increased our 2015 gold reserves to 3.7 million ounces. We are now entering the feasibility stage for the project, which is divided in two phases and should be completed in 2019. The initial *capex* is around \$640 million; we will try to further optimize that during the feasibility phase. If conditions are met, production from the PMR project could start in 2021, and it would extend mine-life significantly. PMR production should be around 240,000 oz/y for the first five years, which, although smaller to oxides production, is still significant and opens the door to unlock other refractory ore sources in the surroundings and would become the first autoclave plant in Peru.

In 2015, Lagunas Norte produced 560,000 oz at an AISC of \$509/oz; \$34/oz less than in 2014. We are at the lower end of costs for Barrick mines worldwide. That shows that Lagunas Norte is a world-class mine; it is one of Barrick's five core sites that will make up around 70% of the total production this year.

Lagunas represented 9% of Barrick's total production in 2015. Our 2016 production guidance at Lagunas Norte is 410,000 to 450,000 oz, at AISC of \$570 to \$640/oz. There is an increase in costs associated to lower production in line with the progressive depletion of the oxides, the ore transitioning to sulfides and a similar level of capital expenditures, mainly the expansion of the Phase 6 of the leach pad.

What is your view of the recent regulatory changes in Peru and the role of the new government?

All regulatory changes for investment promotion and economic reactivation are welcomed. For example, the recent reduction of income tax was a positive initiative. However, the new government still has work to do. Overall, industry regulations could be simplified, especially those related to the environment and permitting. That does not mean lowering the standards, but making them more competitive. One of the biggest challenges is managing the escalation of social conflicts. The government needs to have a stronger presence in the remote areas and provide basic services and development opportunities to ensure that the expectations and needs of the local people are fulfilled.

How strongly do you promote research and development at Barrick?

We are always focusing on innovation and new technologies. As an example, we have a new technology patented by Barrick that is operating commercially as of 2015 in one of our core sites in Nevada. It allows us to extract gold without having to use cyanide. It is called TCM-thiosulfate leaching. We are still working on it to further improve the recovery results. It offers enormous potential, allowing for exploiting complex gold ore bodies.

What are your goals for 2016 in Peru?

We will maintain our focus on operational excellence and continue building upon our partnership culture. In that context, with the progressive closure of Pierina, we want to make it a benchmark, reducing costs and optimizing all the closure processes to showcase it as an example of responsible mining. On Lagunas, we are very excited with the PMR project and the aim will be moving towards feasibility, while we continue to optimize production and reduce costs through several initiatives. Finally, we will continue exploring and looking for business development opportunities in Peru. —



Tim Williams

VP Operations
TAHOE RESOURCES

“

Gold has a luster that combines the sense of wealth and an emotional attachment. At times it is considered a safe haven for investors, and also for buyers that actually want metal. At other times and for other people it is simply a commodity that traders bet on rising or falling trends.

”

How smooth was the integration with Rio Alto and, more recently, with Lake Shore Gold?

The acquisition of Rio Alto was a diversification move for Tahoe, which before just had a silver operation in Guatemala. With La Arena and Shahuindo in Peru, we added gold to our portfolio. The process is 99% complete and the work remaining is to orientate the Lima team to the annual business cycle of the corporate office. With the addition of Lake Shore we are now operating in three regions: Guatemala, Peru and Canada. The corporate office is in Reno, Nevada.

What is the status of the La Arena gold operation in Peru?

In 2015, La Arena produced 230,436 ounces of gold in dore. As of the beginning of the year the proven and probable mineral reserve was 80.3 million mt at an average grade of 0.36 g/mt, containing 919,000 ounces in the ground, and we anticipate that to take us through to 2021. Currently the mine operates at 36,000 mt/d and is doing very well. We are also working on permitting and social licenses to do some drilling in a nearby prospect. We have not closed the Calaorco pit, but expanding it would probably need higher gold prices. We also have the copper resource of 274 million mt at a copper grade of 0.33% and a gold grade of 0.24 g/mt (measured and indicated). Current copper prices are a bit low for us but we continue working on the engineering.

How is the Shahuindo project moving along?

Rio Alto acquired Shahuindo in August 2014. The synergies were its proximity to La Arena and the fact that it was another leach project. Construction started last year and pre-production of gold in dore has occurred each month this year. All the plant components are functioning well and to plan. One difference with the La Arena process is that the Shahuindo recoveries will greatly benefit from crushing and agglomeration. Earlier this year, in the 43-101 report, Tahoe presented the pre-feasibility plan and further engineering work has been completed. The start-up pad with a capacity of 4.5 million metric tons has been completed for the current 10,000 mt/d mine plan. Shahuindo has been doing some metallurgical tests at an industrial scale to better understand the ore and define the best strategies to proceed with the expansion. Shahuindo is expected to operate at 36,000 mt/d as of 2018.

From a social perspective, how different is Shahuindo with regards to La Arena?

Shahuindo was able to integrate the successful programs implemented by Sulliden and also take the successful programs that had been used at La Arena. We have been engaging positively with the authorities and the *caseríos* in our immediate area. So far we have had a positive acceptance by the communities. We have required STRACON GyM and other contractors to use local employment and implement broad training programs. There are also sustainable projects where the mine is not directly involved.

You have reserves for more than 20 years in the country. How important is Peru for Tahoe?

With the combined gold oxide and copper-gold sulfide reserves, there is potential to have a continuous presence in Peru for the next 20 years. Peru is a very important country for Tahoe. Tahoe sees Peru as a ‘mining country’ and will always be looking for good opportunities.

Why is the gold market so volatile?

Gold has a luster that combines the sense of wealth and an emotional attachment. At times it is considered a safe haven for investors, and also for buyers that actually want metal. At other times and for other people it is simply a commodity that traders bet on rising or falling trends. The global economy and perhaps the political cycle in key economies affects the feeling investors have. With the world ever more connected, the economic or political changes anywhere stimulate a faster response in the market. This gives a feeling of volatility.

Gold stocks have not performed well in recent years. What is the positioning of Tahoe Resources in the market?

I agree that the mining industry has done a bit of a disservice in terms of what it can return to investors; gold, particularly, is the speculative end of the mining industry, and projects can be oversold: even the leading players have got projects wrong. Tahoe was at the lower end of the mid-tier spectrum and now, with the acquisition of Lake Shore Gold, we are firmly in the middle or gearing towards the upper tier of that space. We consistently pay dividends and we offer a growth trajectory; our projects are all strong cash producers. We are in a better position than many of our peers, in terms of our cash on hand and debt right now. We are stable and secure, and we have the capability to react to an ever lower gold price if needed. —

Image: Consorcio Minero Horizonte



José de los Heros

General Manager
**CONSORCIO MINERO
HORIZONTE**

24

Horizonte is one of Peru's key private gold producers. Could you give us more details?

Consorcio Minero Horizonte is a privately-held mining company that has been operating for 38 years. Its main asset is the Parcoy mine and plant. The area around Parcoy, the province of Pataz in the hinterland of Trujillo, is a prolific gold district. With 252,000 ounces of gold produced in 2015, Parcoy was the third largest gold mine in Peru.

How did you adapt to lower gold prices?

Metal prices are cyclical, this is nothing new. The group has always been run in a very cautious way, with very little debt. Over the last couple of years, we have been able to lower our costs without having to implement dramatic changes. However, in the longer term cost-cutting is not necessarily the way to go: we believe that the search for efficiency and excellence is what can bring the bigger returns. Our production cost is very competitive if we compare ourselves with other underground gold producers. Still, there are several factors that work against us, namely geography and logistics. We are 14-15 hours by road from Trujillo. For people transportation in and out of the mine, we have an airport with several daily flights, four days a week.

Parcoy is a vein deposit that is reaching 1,000 meters of depth. We envisage the mine to go increasingly deeper, so we are launching a project to build a 1,090-meter, 5-station shaft. It is a \$50 million investment. This will not only reduce transportation costs for the mineral and the waste, but it will also enable us to better explore. The longer-term plan for Parcoy also includes a 17 km tunnel for the lower levels. Our geologists believe that the ore body becomes richer as we go down.

Earlier this year, we also commissioned a filtered tailings plant and deposit, for a total investment of \$55 million. This infrastructure is key to assure the continuity of the operation for the next 20-30 years. Additionally, we increased our plant capacity to the current 2,000 mt/d.

How do you manage safety?

CMH has already implemented significant changes to mechanize the operation, using shotcrete rock support. Of course, we do have some areas that need to be mined using traditional methods, but it is a small portion of the operation. Recently, we have decided to implement an inter-dependent safety philosophy, whereby everybody is responsible for safety, as compared to a guided safety strategy. It is a process that takes time.

As a formal gold mining company, what is the challenge of fighting the public image generated by illegal mining?

Illegal mining is one of the main issues nowadays. What people get to see in the media every other day is bad news about contamination in the Amazon, child labor exploitation and things along these lines. The industry has not been able to communicate all the benefits it brings to the economy; it is a key driver for decentralization, but the public perception is biased by what they see from illegal mining activities.

What are the main highlights for CMH this year?

We are launching our 'Pique Sol' [shaft] project this year, and we expect to complete it in 36 months. We are also implementing special software for running our business that is really changing processes across the company. Also, we have not stopped exploring around our area and we have other concessions around Peru: we are excited about a project that could soon become a lead-zinc-silver mine. —



Marcelo Santillana

General Manager
**COMPAÑÍA MINERA
PODEROSA**

25

How has Poderosa evolved over the last couple of years?

When the gold price started to decline, we followed two strategies to offset that trend: one was to produce more gold, and the other was to reduce our production costs. We increased the capacity of our Santa María plant to the current 600 metric tons per day (mt/d). Bigger volumes brought production costs down, and we worked on lowering the cost of supplies, which had gone up significantly between 2011 and 2013. By 2015, we already had good results in cutting costs, helped by the declines in the market price for cyanide, steel, wood, and oil. For example, cyanide went from nearly \$3 per kilo to \$1.

We also increased our productivity: we dig about 30,000 meters of tunnels per year, so achieving efficiencies to reduce timelines reduces overall costs. Last year we had good results despite the lower gold prices. On the energy side, we still have not found the financing for our hydropower project, but in the meantime we are going to build a transmission line to get additional capacity from the grid. Right now we use around 9 megawatts (MW). As we grow our production in the Santa María plant, which will reach 800 mt/d by 2017 and 1,000 mt/d after that, we will need more power.

What were the final results for 2015 in terms of production and costs?

We closed 2015 with a production of 190,000 ounces (oz) of gold. For this year, our guidance is 205,000 oz, and in the medium term we should reach 230,000 oz/y. Our gold price estimation was \$1,150/oz for 2015. For 2016, we were quite conservative and we budgeted a price of \$1,050/oz. My personal expectation is that gold will not go below \$1,100/oz in the upcoming months, due to the uncertainties in world markets.

With regard to costs, in 2015, we had a net operating cost of \$512/oz, while in 2014 it was \$609/oz. In terms of the cash cost, it was \$655/oz last year.

Geologically speaking, what is the upside potential for Poderosa?

We have 580,000 oz in reserves, 590,000 oz in resources and overall potential for around 8 million oz in the Pataz district. We have always been successful in our exploration activities, especially in the Santa María area. We have two mines in production, and we also source minerals from artisanal miners, which represents around 15% of our total gold production.

What should the new government do to allow for further investment in mining?

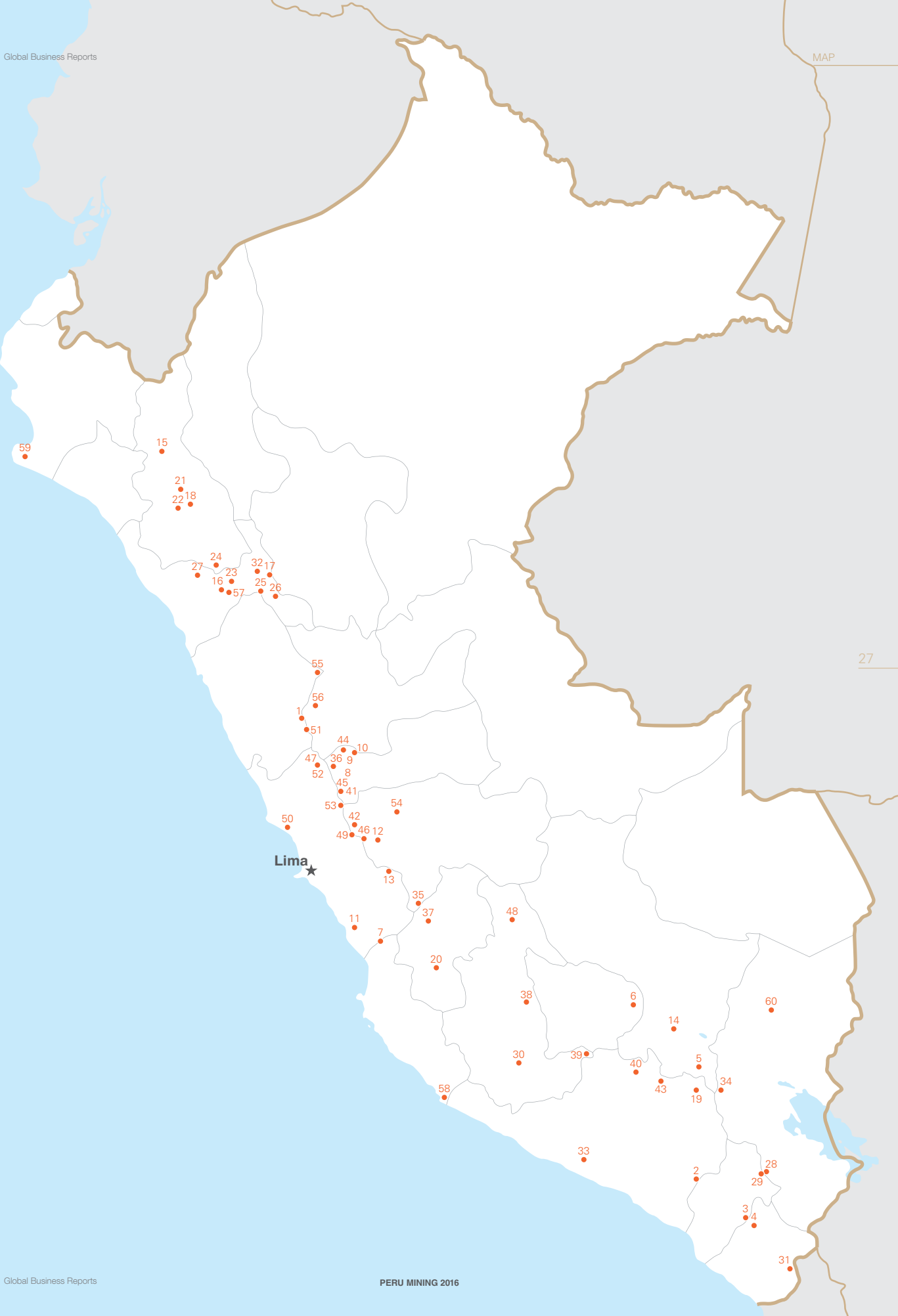
There have been many regulatory changes during the Humala administration that have changed the interaction between local communities, the environment, the State and the mining operations. I hope that the new government has a calmer approach with regard to new regulation. The country needs to be attractive for investment; if we do not create the right framework, other countries like Colombia will be seen as more advantageous. Investment is central to the development of the country, not only in mining but at every level.

What sort of initiatives do you undertake through *Asociación Pataz*?

Asociación Pataz is the arm that handles our work with the communities for the long term. We have worked around different goals, such as education, health, nutrition, infrastructure, and governability. We have tried to empower the communities so that they can be the drivers of their own development. Recently, we have assisted four communities in obtaining electricity from the national grid. —

PERU'S MAIN MINES

NUMBER	MINERAL	COMPANY	MINE
1	Copper, Molybdenum, Silver, Lead, Zinc	Antamina (BHP-Glencore-Teck-Mitsubishi)	Antamina
2	Copper, Molybdenum	Cerro Verde (Freeport-Sumitomo-Buenaventura)	Cerro Verde
3	Copper, Molybdenum, Silver	Southern Copper	Cuajone
4	Copper, Molybdenum	Southern Copper	Toquepala
5	Copper, Gold, Silver	Glencore	Antapaccay
6	Copper, Molybdenum, Gold, Silver	MMG	Las Bambas
7	Copper, Silver, Lead, Zinc	Milpo	Cerro Lindo
8	Silver, Lead, Zinc, Copper	Milpo	El Porvenir
9	Silver, Lead, Zinc, Copper	Milpo	Atacocha
10	Copper, Gold, Silver, Lead, Zinc	El Brocal (Buenaventura)	Colquijirca
11	Copper, Gold, Silver	Southern Peaks Mining	Condestable
12	Copper, Silver	Doe Run	Cobriza
13	Copper, Silver, Lead, Zinc	Sierra Metals	Yauricocha
14	Copper, Silver, Molybdenum	Hudbay Minerals	Constancia
15	Gold	Yanacocha (Newmont-Buenaventura)	Yanacocha
16	Gold	Barrick	Lagunas Norte
17	Gold	Barrick	Pierina
18	Gold, Copper	Gold Fields	Cerro Corona
19	Gold	Buenaventura	Orcopampa
20	Gold, Silver	Buenaventura	Breapampa
21	Gold	Coimolache (Buenaventura-Southern)	Tantahuatay
22	Gold	La Zanja (Buenaventura-Newmont)	La Zanja
23	Gold	Tahoe Resources	La Arena
24	Gold	Tahoe Resources	Shahuindo
25	Gold	C.M. Horizonte	Parcoy
26	Gold	Retamas	Retamas
27	Gold	Santa Rosa	Santa Rosa
28	Gold	Aruntani	Andrés-Arasi
29	Gold	Aruntani	Mariela
30	Gold	Aruntani	Apumayo
31	Gold	Minsur	Pucamarca
32	Gold	Poderosa	Poderosa
33	Gold	Caravelí	Capitana
34	Gold	Titan	Belén
35	Gold	Minera IRL	Corihuarmi
36	Silver, Zinc, Lead	Buenaventura	Uchucchacua
37	Silver	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	Cerro de Pasco
45	Silver, Lead, Zinc	Volcan	UAE Chungar
46	Silver, Lead, Zinc	Volcan	UAE Yauli
47	Silver, Lead, Zinc	Glencore	Iscaycruz
48	Lead, Zinc	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	Zinc, Copper, Silver	Nyrstar	Contonga - Pucarrajo
56	Copper, Silver, Lead, Zinc	Raura	Raura
57	Silver, Lead, Zinc, Copper	C.M.Quiruvilca	Quiruvilca
58	Iron	Shougang	Marcona
59	Phosphate	Vale-Mosaic-Mitsui	Bayóvar
60	Tin	Minsur	San Rafael





Ignacio Bustamante

CEO
HOCHSCHILD MINING

The last months have been eventful for Hochschild. Could you summarize the main changes?

2015 has been a transformational year for the company. The most important development has been Inmaculada, which started operating in July 2015 and has been surpassing all of our goals. It has become the backbone of the company in terms of production and margin contribution. The second point is that we were able to meet and exceed our aggressive targets, with an output of 27 million silver equivalent ounces, and all-in sustaining costs (AISC) of \$12.9 per ounce in 2015, a 30% reduction year-on-year. Then, in Pallancata, we made the Pablo discovery, which has changed the outlook for that operation with 2.5 to 3 years of additional production and reduced costs.

For Inmaculada we had incurred debt to finance the acquisition of the 40% stake held by our partners and the construction of the project. When silver prices decreased, we decided to raise equity through a rights issue to repay part of our debt. Now, in 2016, we are in a much better position, yet we are still setting very aggressive goals. Our production target company-wide is 32 million ounces this year, of which Inmaculada will contribute 14 million. We expect to decrease AISC from \$12.9 to \$12-12.5. We want to put Pablo into production by December, and we want to continue reducing our debt levels.

Finally, we need to keep working on our geological potential. Even at the average silver price of \$15.7 per ounce in 2015, we managed positive cash flow in all our operations. This is good because, if you look at other primary silver producers, many have a mix of good assets and assets that are not profitable. When we prepared our 2015 budget with conservative prices, we realized that Arcata and Pallancata were not producing all of their ounces in a profitable manner, so we decided to reduce mine throughput. At Pallancata, we reduced throughput from 3,000 metric tons per day (mt/d) to 1,000 mt/d. Once Pablo comes into production we will be using 2,000 to 2,200 mt/d. At Arcata, we went from 2,500 mt/d to 1,500 mt/d initially, but we found more profitable material so we went up to 1,800 mt/d. We also have our Ares plant

completely idle. All of which means that we have around 2,700 mt/d of spare capacity between the three plants, so our focus this year will be to find resources to use as much as possible from this capacity, which does not need any new permits, social licenses, environmental studies or financing.

Could you give us some more facts and figures about Inmaculada?

Inmaculada represented a total investment of \$440 million. The mine has about 8 years of resources and a lot of geological potential. The target is to produce 14 million ounces per year at an AISC of \$9-10 per oz. Nameplate capacity was 3,500 mt/d and we are operating at 3,850 mt/d. We believe that, with a marginal investment, we can go to 4,200 mt/d, and with an additional efficient investment we can take it up to 5,000 mt/d. Before we decide on these, though, we need to confirm additional resources. Inmaculada is 70% gold-30% silver. With this mine, as a company we now have around 50-50 split between gold and silver.

Will this trend towards more gold continue with your Volcan project in Chile?

Our Chile acquisition was made thinking of the long term. The asset has around 10 million ounces of gold, which is a very large resource. Right now it does not necessarily sit on the top quartile of cash costs for gold deposits, but if you look at the market, grades are declining and production is falling worldwide. Comparatively speaking, this deposit is going to look much better over the next 5 to 10 years.

How do you expect gold and silver prices to evolve?

It is difficult to predict pricing trends for the short term, but for the long term we are very enthusiastic. The demand is going to continue growing, and the supply is decreasing. If you look at last year, the movement of gold and silver prices directly correlated to what happened in the U.S. economy. If the economy gives a weak signal, prices go up. If the Fed says it is going to increase interest rates, prices go down. From a gold and silver supply standpoint, we could see a potential upside getting into 2017. —



Steve Busby

COO
PAN AMERICAN SILVER

How has Pan American Silver evolved over the past year?

In 2015, Pan American Silver focused on cutting costs, improving productivity and retooling our operations to survive the downturn in commodity prices. Assisted with the global oil price reduction, as well as currency exchange improvements, we succeeded in reducing our costs. We have a very large balance sheet; we started the year with \$267 million. We are using this money to fund our two large-scale

growth operations at La Colarada and Dolores in Mexico.

What have been the latest key developments in your Peruvian mines, Huarón and Morococha?

Both Huarón and Morococha are polymetallic mines, which produce lead, zinc, copper, silver and a little bit of gold. We have been successful over the past several years in mechanizing both of these mines, in an effort that comes together with an exploration strategy to target larger ore bodies as opposed to narrow veins. Lower energy prices and local currency devaluation are also helping us to drive down our costs and maintain our operations right on the edge of being cashflow positive. We were successful in finding larger ore deposits, particularly for copper at Morococha, where the operation had been disrupted late last year after we intersected some water in the main mining zones. Current base metals prices and our resource base do not allow us to increase production, so we are focusing on keeping both operations at least break-even or better. We very much like these poly-metallic resources, because they are so vast and offer exposure to a variety of different metals that provides us diversity to weather certain market downturns.

Most mining fatalities in Peru occur underground. What can be done to bring the statistics down to zero?

The government has been increasing safety standards and stringency for compliance. We welcome and fully support these changes as safety is our number one priority. The government's goals are the same as ours. Today's

modern mechanized mining methods allow for bigger openings, bigger equipment and the installation of modern ground-control systems to prevent rock falls with more reliability than older methods. As an important part of our training process, we educate our employees and contractors about their personal safety and the importance of carefully evaluating the environment in which they have to work each day. Our safety record has improved dramatically and we believe this is also the general direction that mining companies in Peru are taking.

Pan American Silver enjoyed another record year in terms of silver production. What are the estimates for 2016?

Indeed, in 2015 we produced 26.1 million ounces of silver. We are looking to come off these rates a little bit in 2016 as our Álamo Dorado mine in Mexico, which has been our largest producing mine for the past eight years, has been exhausted. We made our last open pit blast on December 27, 2015. We have stock pile resources which may allow us to continue to run the processing plant through 2016 and perhaps into 2017. We are forecasting production of 24.5 to 25.5 million ounces of consolidated company silver production this year. As we finish both expansion projects at La Colorada and Dolores, we expect to be able break another silver production record in 2018. We are a strong, growing company. We continue to expand, while others are contracting their operations. We are generating new jobs and generating value for our shareholders during a time when very few companies are able to do that. —

“It is difficult to predict pricing trends for the short term, but for the long term we are very enthusiastic. The demand is going to continue growing, and the supply is decreasing. If you look at last year, the movement of gold and silver prices directly correlated to what happened in the U.S. economy.”



TUMI
RAISE BORING

**YOUR COMPLETE
RAISE BORING SOLUTION!**

MORE THAN 40 YEARS OF DRILLING EXPERIENCE



Tel: +51 (1) 717 8034 RPC: 968 289 294
Email: sales.ventas@tumiraiseboring.com



Large Copper Producers

Cerro Verde, Las Bambas, Constancia and Toromocho are all adding new production to the market

In the years between 2005 and 2014, Peru's yearly copper production only increased by 370,000 mt/y. 2015, however, was the start of a big transformation: production increased by 321,000 mt/y to reach 1.7 million mt/y. In 2016, the forecast is to reach 2.3 million mt/y, solidly placing Peru as the world's second largest copper producer.

While Las Bambas and the expansion of Cerro Verde stole most of the headlines in 2015 due to the sheer size of these investments (\$7.4 billion and \$4.6 billion respectively), production-wise it is actually this year that they are making a big difference. Las Bambas, for instance, declared commercial production in July 2016. The main drivers of 2015's output increase were Chinalco's Toromocho, which finally overcame its technical difficulties to produce 182,000 mt/y (+159%) and Constancia, a brand new operation by Hudbay Minerals that yielded 106,000 mt/y.

All the other majors also contributed with increased production: Antamina went from 362,000 to 412,000 mt/y. Glencore's Antapaccay produced 203,000 mt/y as compared to 167,000 one year before. Cerro Verde reached 256,000 mt/y (+9%) while Southern Copper's production remained fairly stable at 322,000 mt/y (+1%), divided in two operations, Toquepala and Cuajone. The company is investing \$1.2 billion to expand Toquepala's concentrating capacity to 120,000 mt/d.

The expansion of Cerro Verde is a key milestone for Peru and for the region of Arequipa. The concentrator is trebling in size to reach a capacity of 360,000 mt/d. This places Cerro Verde as one of Freeport-McMoRan's top three operations. Harry 'Red' Conger, president & COO for the Americas and Africa at Freeport, said: "We have several mines that are capable of producing 1 billion pounds [453,000 mt] of copper annually today or in the future. Cerro Verde, Grasberg and Morenci are essentially at that rate today."

Conger explained that focusing on large, expandable assets rather than developing new deposits is paying off: "One of the strategic advantages of Freeport-McMoRan is that there is less risk associated with doing a brownfield expansion than with a new greenfield installation. These are natural advantages at a location like Cerro Verde; we had the infrastructure in place, we had a port



Image: Cerro Verde

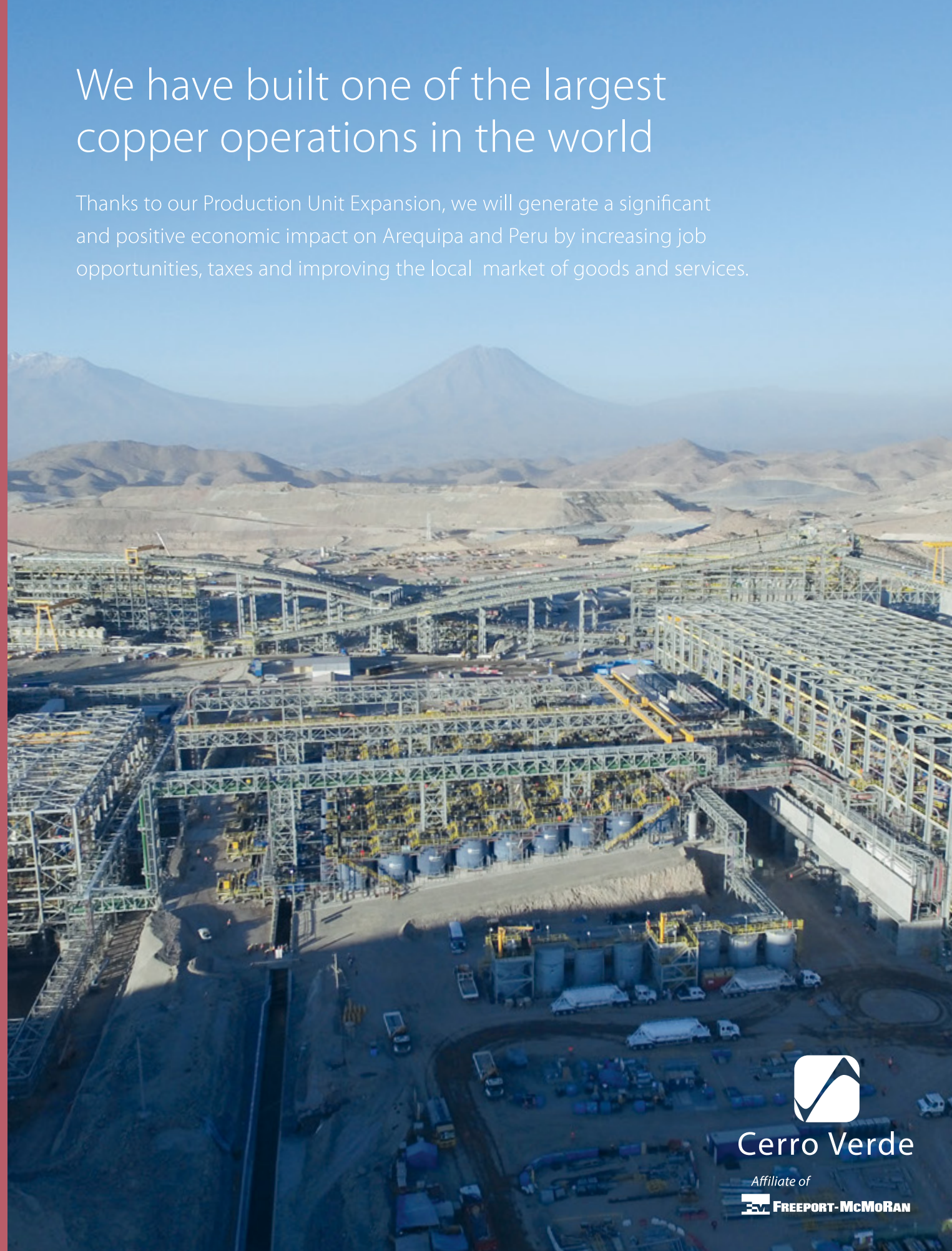
(although we had to expand it), and we had a world-class, highly-trained Peruvian workforce."

Rick Coleman, president of Freeport-McMoRan Mining Company, gave more details on the expansion: "At the time that the original concentrator was commissioned, mine-life was 70 years at a 120,000 mt/d rate. We had good recovery rates and the concentrate was very clean and easy to sell, so the economics of the expansion were favorable. It was a \$4.6 billion investment to add 240,000 mt/d of nameplate capacity to the concentrator facilities. An additional \$1 billion was spent during the expansion project for a new leach pad, improvements in the existing concentrator and SX/EW facilities and the relocation of existing infrastructure, among others."

With regard to Constancia, Hudbay Minerals has changed the mine's cost structure to adapt to current copper prices. Cashel Meagher, Hudbay's senior VP and COO, explained that higher production over the first years of operation is helping weather the storm: "We purchased this project at copper prices of \$4.27/lb. We still have a margin with AISC of \$1.51/lb Cu (Q1 2016); however, the current prices are impacting our original thesis on payback. Right now, we are exploiting a high-grade portion of the deposit at Constancia due to supergene enrichment at the top of the mine. This year and next year are the sweet spot for Constancia in terms of high grade and short haul distances." —

We have built one of the largest copper operations in the world

Thanks to our Production Unit Expansion, we will generate a significant and positive economic impact on Arequipa and Peru by increasing job opportunities, taxes and improving the local market of goods and services.



Cerro Verde

Affiliate of

FREEPORT-McMoRAN

Gustavo Gomes

President
MINERA LAS BAMBAS (MMG)



Las Bambas started commercial production recently. Could you summarize the main milestones of this new project? Putting Las Bambas into production was a big challenge from both an operational and a social perspective. The company has been working with the local communities since it started activities more than a decade ago. In late 2015, we began the commissioning phase, and we reached commercial production on July 1st 2016; this is just six months after the start-up, which is a record in the industry, and is quite rare for mega-projects of this size. We produced 31,470 mt during the first quarter of 2016. Today, the mine and the plant are already operating at their nominal treatment capacity of 50 million metric tons per year (mt/y).

With Las Bambas, how important is Peru for MMG worldwide? The acquisition of Las Bambas was a transformational milestone for MMG. Las Bambas is expected to yield over 2 million mt of copper in concentrates over its first five years of operation and, that way, it will become one of the top five copper mines in the world. Las Bambas is also a solid platform for MMG's growth in Peru and South America, as it will lay the groundwork of a mining model that promotes sustainable development in the communities around its operation.

How important are the 'multi-actor' negotiation tables that have been promoted in Peru over the last years? Dialogue tables play an important role because they are institutionalized spaces that reunite the State at all its levels with civil

society. We are also an actor and we participate in these tables; the aim is to find solutions that address the needs and requirements of the affected populations.

How do you think the relocation of Fuerabamba worked for its people? The relocation to Nueva Fuerabamba is a successful example for the industry. It was the result of a free and informed process of dialogue and consultation between the community and the company. The agreement, signed in 2010, included several benefits, such as the construction of new homes and a services infrastructure where there are schools, a health center, churches, recreation areas, a market and others. All these were identified by the community as a means to create high and sustainable standards of living, while preserving their identity. On top of economic compensation and the reinstatement of land, homes and infrastructure, the members of the community receive support by professionals to adapt to the new environment and develop their livelihoods sustainably, through a systemic development plan.

Southern Peru is a key copper district worldwide. How is mining improving living conditions, and what can the State do to continue this process? The southern Andes host mineralized areas of great potential. In this respect, the mining industry has a great opportunity due to its multiplying effect and its capacity to generate sustainable development for its areas of influence, the region and the country. In Las Bambas we implemented an intense campaign of social work even

before we started production, to build trust with the communities and promote development in our area of influence. To date, we have invested over \$250 million in sustainable development projects.

In Apurímac, poverty rates went down from 57% to 39% between 2011 and 2015, according to official figures. Investment, including public and private, grew by 20% every year. Over this period, the number of direct jobs grew by 50%, and salaries increased by 30%. To a large extent, this has been possible thanks to the implementation of the Las Bambas project. The State has also been an important actor, assisting with various infrastructure projects. One key issue is the capacity of the authorities to execute these projects and do it rapidly; in addition to our own direct projects, we work strongly with the State and the local authorities to accelerate the execution of public ventures.

What was Las Bambas' safety record during construction, and what are your main initiatives regarding safety moving forward? Safety is Las Bambas' most important value. We make sure that this approach is shared by all the team, including our contractors and suppliers. We also share it with the adjacent communities, where we have a significant number of collaborators and providers. Our operational objectives are aligned with our standards and procedures for risk prevention that aim at making Las Bambas a injury-free workplace. We comply with all the relevant regulation, while we also run our own management systems, mitigation measures and controls. —

Bruce Clements, Rick Coleman & Harry 'Red' Conger

BC: Past President*
CERRO VERDE
RC: President
FREEPORT-MCMORAN MINING COMPANY
HC: President &
COO Americas and Africa Mining
FREEPORT-MCMORAN INC



BC



RC



HC

*Since August 2016, the new President of Cerro Verde is Derek Cooke

How does the expansion of Cerro Verde enhance Freeport's positioning in the copper spectrum? Harry Conger (HC): We are the number 2 copper producer in the world and the largest publicly-held copper producer worldwide. We have operations in the U.S., Chile, Peru, Indonesia and the DRC. We have several mines that are capable of producing 1 billion pounds of copper annually today or in the future. Cerro Verde, Grasberg and Morenci are essentially at that rate today. One of our strategic advantages is that there is less risk to doing a brownfield expansion than a new greenfield installation. These are natural advantages at a location like Cerro Verde, which is one of our top three operations. Rick Coleman (RC): When the original concentrator was commissioned, mine-life was 70 years at the 120,000 mt/d rate. We had good recovery rates and the concentrate was very clean and easy to sell, so the economics of the expansion were favorable. It was a \$4.6 billion investment to add 240,000 mt/d of nameplate capacity to the concentrator facilities. An additional \$1.0 billion was spent during the expansion project for a new leach pad, improvements in the existing concentrator and SX/EW facilities, and the relocation of existing infrastructure, among others.

From a construction perspective, what was the challenge of building such a large project? RC: Our contractors included large firms with mega-project experience in the region. We had over 21,500 workers at the peak moments of construction. Of that, we committed to have 50% of them being local people from Arequipa. We also had a great relationship with our suppliers, like Polysius, FLSmidth and Metso. They made the plant easy to start-up. Bruce Clements (BC): We also have a group of local contractors from Arequipa that have grown up together with Cerro Verde. In 2011, we had around 2,000 direct employees for the operation; today, we have 4,000 employees, as well as 1,000 contractors for the ongoing projects. Our goal this year is to completely stabilize the operation and optimize all processes.

In terms of new technologies, what does the expanded Cerro Verde bring to the table? RC: We are using cutting-edge technology. The high-pressure grinding rolls (HPGRs) are much more power-efficient as compared to a SAG mill. We have the latest shovels from Joy Global. We have the latest technology in slope monitoring, where we are surveying the pit with lasers. We have a system that takes the real-time mechanical health information from our haul trucks into a control room. We have scanning electron microscopes for mineral characterization. We are also licensed to use drones in our properties and we are working on this technology to inspect tailings. Along the same lines, we also use satellite images to monitor the development of the operation.

Cerro Verde invested in a water treatment plant for its operation and the city of Arequipa. Could you provide more details? HC: Arequipa is the second largest city in Peru and most of their raw sewage was going directly into the river. We proposed to build a sewage treatment plant to clean up the water and use an annual average of a cubic meter per second of that treated water for our mineral process. With the improved water quality, farmers downstream now have a wider choice in terms of what they can produce. BC: We have been working very closely with the farmers in Arequipa. They use approximately 71% of the available river water, we use another 10%, and the city, the remaining 19%. There is more water than people believe there is.

What safety strategies do you have in Cerro Verde? BC: We spend a lot of time training people and making sure they understand all procedures, and the same applies to contractors. Working on safety every single day is an essential factor of our success. We draw a lot upon the bigger company for the worldwide procedures that we have learnt over many years, and work on our own safety programs on site as well. We encourage people to stop working if they see an unsafe operation, but people in Peru often do not get that message in other industries, so it takes time. Today, Cerro Verde has one of the best safety records around Freeport McMoRan. —

Cashel Meagher & Eric Caba

CM: Senior VP and COO
EC: VP South America Business Unit
HUDBAY MINERALS



CM



EC

Constancia reached commercial production in 2015. How is optimization moving along?

CM: The optimization process is working extremely well, both in the mine and at the mill. We are working above our nominal throughput capacity. At the mine itself, we are undergoing an important project this year; we will move from contract mining to self-performance, as part of our focus on cost reduction.

EC: When we started processing ore, we ran into higher levels of oxide minerals than we initially expected, which caused lower recoveries, but we also ran into higher grades, so there were no significant changes on the production levels. As we are working our way down deeper into the ore body, we are also optimizing recoveries, so we should be reaching the expected 88% recovery for the life of the mine.

Could you solve the logistics issues with the stockpile?

CM: Late last year, we built up a stockpile of 65,000 metric tons (mt) of concentrate. The mine should normally maintain a stockpile at around 10,000 mt. There was a shortage of trained drivers in Peru with proper qualifications. Concentrate is a dangerous good according to the regulations, even if our concentrate does not have arsenic or lead. For this reason, drivers need a special license and several years of experience. Cerro Verde, Las Bambas and Antapaccay were all competing for the same pool of drivers. We had to build up driver capacity and the problem has been resolved now.

What is Constancia's cost position?

EC: For construction we hit good timing, because there were no other major projects

going on, so we did not have to compete for resources with the contractors. The mine design is excellent and compact. Average grade, however, is 0.36% Cu, so we are going to have to be efficient.

CM: We have changed our cost structure: it is about cost conservation and deferrals wherever we can. We initiated a task force to go back to all suppliers and renegotiate contracts. At some point in January, copper was below \$2/lb. We do not see much change between now and the end of the year, and probably by the end of 2017 some high-cost producers will no longer be able to maintain production. My personal feeling is that most mines have trouble ramping up and that there is a lot of optimism built on the supply curve. Producers in Chile, for instance, are being somewhat optimistic in terms of their grade and production schedules when they transfer from open pit to underground block caving.

We purchased this project at copper prices of \$4.27/lb. We still have a margin with AISC of \$1.51/lb (Q1 2016); however, the current prices are impacting our original thesis on payback. Our goal over the life of the mine would be to keep AISC below \$1.80/lb. Right now, we are exploiting a high-grade portion of the deposit at Constancia due to supergene enrichment at the top of the mine. Beyond 2017, our metal production should go down. We have an expansion opportunity with the Pampacancha satellite pit, which has higher grade. This would improve our metal production, but we would also incur on longer hauls. This year and next year are the sweet spot for Constancia in terms of high grade and short haul distances.

In terms of your relationship with the local communities, how did you manage the transition from construction to operations?

age the transition from construction to operations?

EC: We had 8,000 people on site at the peak of construction, out of which 1,100 to 1,200 were from the local community. It was not easy to reach a balance between experienced people and untrained local workers. We made sure that the reduction of the workforce, once construction was completed, would not take the locals by surprise. As Hudbay, we had extensive experience in community relations in Canada. In Peru, we try to be lobbyists for the communities in front of the government, to bring the authorities to the area. We want to be a facilitator in the region.

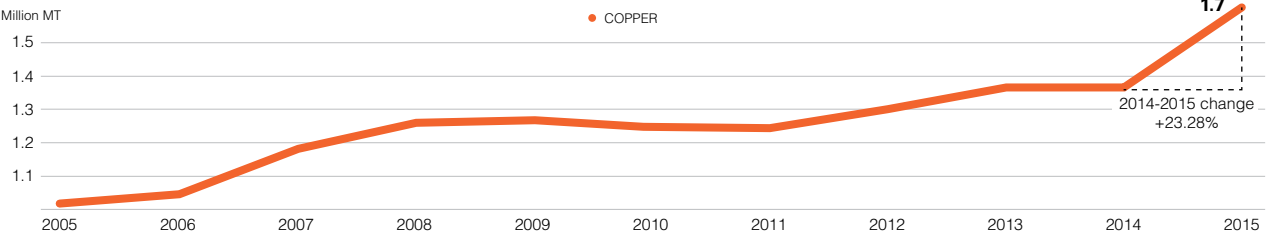
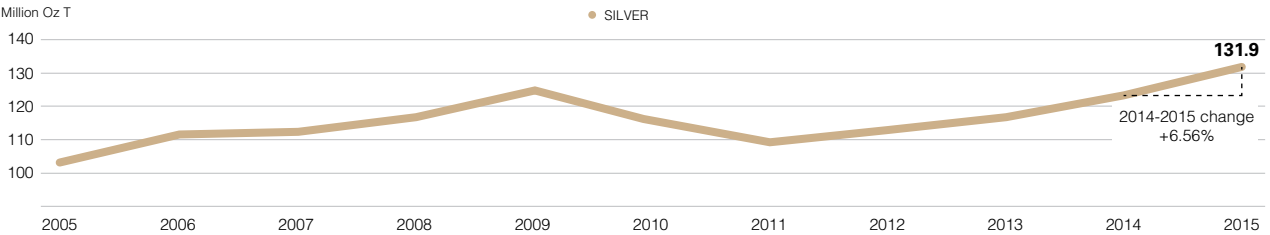
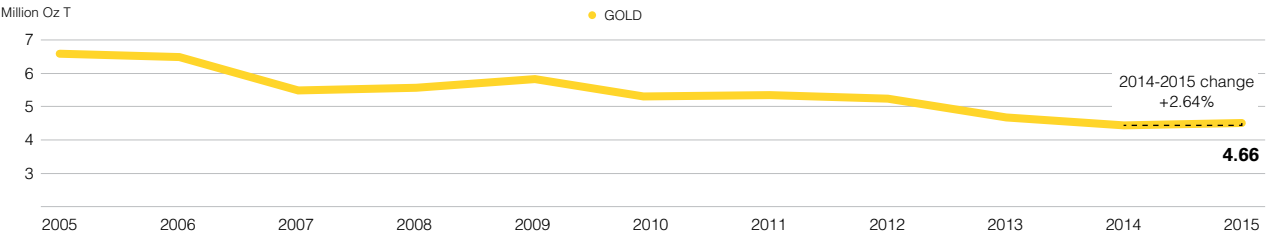
What is Hudbay's growth vision in the Americas?

CM: We have picked up 50,000 new hectares of mineral rights in Ancash, Arequipa and Cuzco. We have also picked up 50,000 hectares of land options in the area of La Serena in Chile. We have a grassroots exploration focus and we monitor all ongoing projects, whether at a PEA level with a junior, or at a feasibility level with a major, because a lot of assets have been put up for sale. Within Constancia, we have the option for the higher-grade satellite pit. We believe there is upside potential at Lalor, in Canada. In Arizona, once we see ourselves in a favorable financing environment, we will move ahead with the Rosemont project.

EC: Hudbay currently offers one of the best exposures to the next swing of commodity prices for copper investors. Rosemont is looking to be the first mine out of the chute when copper prices turn around.

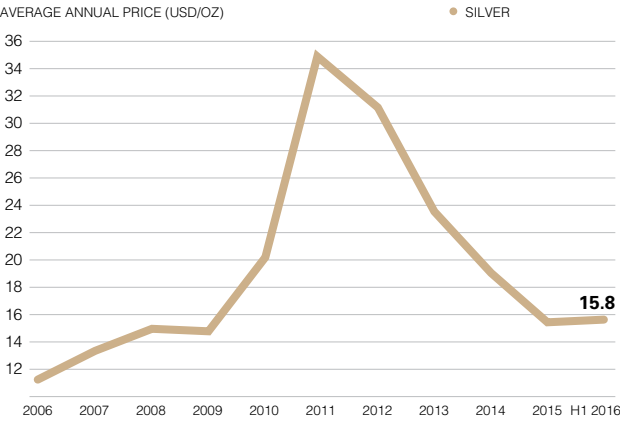
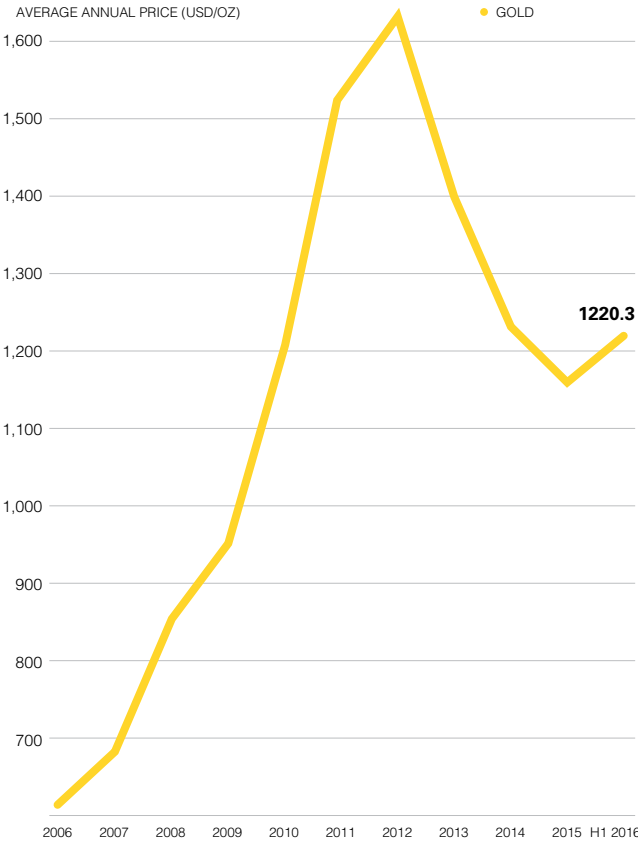
PERU, A DIVERSIFIED METALS PRODUCER

Source: Ministry Of Energy And Mines / GBR



GOLD AND SILVER PRICE CHARTS

Sources: KITCO / GBR



PODEROSA
EL PODER DEL ESFUERZO CONJUNTO
The power of joint effort

Base Metals

Peru is blessed with a diversity of minerals

Copper is not only produced in large-scale surface operations; Peru is home to a good range of medium-sized underground mines that produce the red element as well as other base metals such as zinc and lead. One of the main players in this segment is Milpo that, with the support of Brazil's Votorantim Metais, its mother company, is building an important growth profile with a portfolio that includes the Magistral and Michiquillay copper projects in Peru, as well as the Aripuanã polymetallic project in Brazil.

After expanding to 18,000 mt/d, Milpo is again increasing capacity at its flagship operation, Cerro Lindo, to reach 20,000 mt/d this year. Cerro Lindo produced 184,000 mt of zinc and 41,000 mt of copper last year. Meanwhile, it continues the integration of its Pasco complex, where the Atacocha and El Porvenir operations process a total of 11,000 mt/d. With regard to Magistral, the project has an approved feasibility study and the EIA has been submitted to the authorities. Milpo's plan is to start with a 10,000 mt/d operation and then expand to 30,000 mt/d, for a total mine-life of 24 years. "Magistral is clearly our most advanced project," said Víctor Gobitz, CEO of Milpo.

Another company that is growing its mining portfolio in the region is Minsur, part of one of Peru's largest economic conglomerates, the Breca group. Traditionally positioned as one of the world's largest tin producers with the San Rafael mine in Peru, the company also owns a tin smelter in Peru and a mining and metallurgical complex in Brazil where it produces tin, ferro-niobium and ferro-tantalum. Besides this, it also operates the Pucamarca gold mine in Peru (with production of 118,000 oz in 2015), and it also has a 70% stake in Mina Justa, a large copper project that would elevate the company to a completely different level, as it would require a capital investment of \$1.2 to \$1.4 billion. Based on the San Rafael deposit, tin still represents 75% of Minsur's business. Although today's grade of 2% tin is half of what the

company had a few years ago, it is still twice as rich as other operations worldwide, explained Juan Luis Kruger, CEO of Minsur: "Production is 20,000 mt/y, and we have reserves and resources for nine more years. We have just implemented the Ore Sorting project, a \$20-million investment to pre-concentrate low-grade mineral at San Rafael using X-ray. Moving forward, we also have the B2 project for tailings re-processing. It will allow for additional production of 5,000 to 6,000 mt/y of fine tin. It will require an investment of \$180 million, and production should begin in 2019."

Among medium-sized producers, there is a strong focus on the modernization of old underground operations. Southern Peaks Mining, an underground mining operator, recently decided to sell its Quiruvilca mine, which it had acquired from Pan American Silver four years ago, to a private group. With this transaction, Southern Peaks can focus on increasing productivity at Condestable, which had an output of 19,000 mt of copper last year, while it is also moving closer to a production decision at Ariana, a development project.

Adolfo Vera, president & CEO of Southern Peaks Mining, outlined the company's efforts to modernize Condestable: "Condestable used to be a spread-out operation and we have centralized it. The main mining method now, accounting for 60-70% of total production, is sublevel stoping (long-holes), as opposed to 15% before. This reduces the cost per mt immediately."

Other underground producers that are working hard to modernize their operations and beat the low metal prices are Sierra Metals at Yauricocha and the aforementioned Compañía Minera Quiruvilca, where larger copper veins at depth may provide a better scenario than the traditional narrow veins in the deposit. Luis Sáenz, CEO of Quiruvilca, explained that modernization is not an option but an obligation: "Without mechanization, we are highly exposed to low commodity prices," he said.

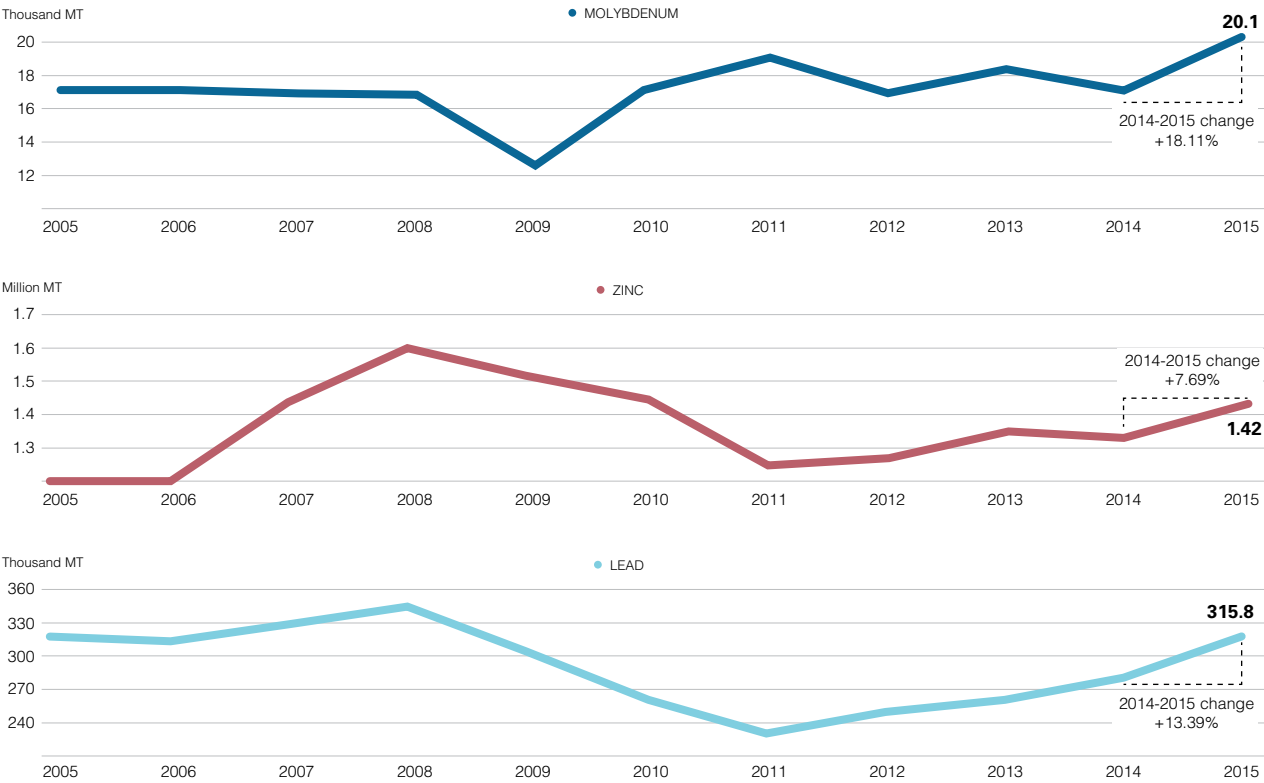
“Mechanizing Quiruvilca is very challenging because it is a very old mine that has always been exploited using traditional, manual methods. The veins are very narrow so that makes it even more difficult. Luckily at depth we have found some larger copper veins, and we are in the process of evaluating a mechanized mining method there. Without mechanization, we are highly exposed to low commodity prices.”

- Luis Sáenz, CEO, C.M.Quiruvilca

”

PERU, A DIVERSIFIED METALS PRODUCER

Source: Ministry Of Energy And Mines / GBR



EXPERIENCED MANAGEMENT TEAM
TO DELIVER GROWTH

OPERATING ASSETS
WITH STRONG CASH FLOW

FOCUS ON SUSTAINABLE
LONG TERM VALUE

SOUTHERN PEAKS
MINING LP

CONDESTABLE
Lima, Perú

ARIANA
Junín, Perú

Av. Manuel Olguín 501
Edificio Macros, Oficina 803 - Monterrico

info@spm.pe | (511) 200-5000
www.southernpeaksmining.com

Víctor Gobitz

CEO
MILPO



What have been Milpo's recent developments?

2015 was a difficult year, especially during the second half. Yet, we had positive EBITDA and our production results were also positive - higher than in 2014 in the case of lead and silver. Important milestones of the year include the consolidation of Cerro Lindo at a production rate of 18,000 mt/d; the integration of the two tailings dams at Atacocha and El Porvenir; the start-up of a small open-pit operation at Atacocha; the presentation of the private initiative for Michiquillay; and the presentation of the feasibility study for the Magistral project to Proinversión.

Has the higher dollar helped reduce costs?

Our cost structure is highly tied to the US dollar, up to 70% of the total, while just the salaries and taxes are payable in local currency. So, the exchange rate has not affected us much. The expansion of Cerro Lindo has allowed us to lower our costs per metric ton, while the integration of Atacocha and El Porvenir reduces the sustaining capital required and the operational costs. Cerro Lindo is between the first and second quartile of costs worldwide, while El Porvenir is between the second and the third quartile. Atacocha has higher costs but the integration with El Porvenir will reduce costs there.

Can we have more details on the integration of Atacocha and El Porvenir?

We are integrating the tunnels and we are also going 400 meters deeper at El Porvenir, to incorporate more reserves at Atacocha that are not accessible now, thanks to

the new hoisting system. Integration is currently taking place at our 3,300 level while we are also exploring higher zones at Atacocha, in a zone called San Gerardo. This is going to give us more time to develop the lower zones underground. As long as we have good ore from the upper zones, we will not need the infrastructure deep down. San Gerardo is an open pit producing at a small scale; it has a permit for 1,000 mt/d, but it can grow significantly moving forwards.

Then we have Shalipayco, a project in the Junín pampas located just 60 km from our Pasco complex. It is actually closer to two plants by El Brocal and Volcan that have excess capacity. Using one of these third-party plants, we would reduce transportation costs and we would save the capital investment to expand our El Porvenir plant. The plan for our Pasco complex is to continue operating our two plants at Atacocha and El Porvenir. When the material over the 3,300 level is exhausted, all the ore mineral will be processed at El Porvenir, which will then require expanded capacity. Right now, both Atacocha (4,500 mt/d) and El Porvenir (6,500 mt/d) are working at full capacity. Shalipayco would require an extra capacity of 2,000 or even 3,000 mt/d.

How is Cerro Lindo doing, and what are your most advanced development projects?

At Cerro Lindo we are expanding capacity to 20,000 mt/d. This requires minimal investment; we are eliminating some bottlenecks and all we need is to obtain permits. This expansion should be completed this year. Magistral is clearly our most advanced

project. The feasibility study has been approved by Proinversión and we have presented the EIA to the authorities. It is an open pit operation where we are applying a modular approach. It has the potential to process 30,000 mt/d, but we plan to start at 10,000 mt/d focusing on the higher-grade material to have a faster return on the investment. Mine-life would be 24 years. After Magistral, our most-advanced project is Aripuanã, which we are developing with Votorantim. It is a polymetallic project in Mato Grosso, Brazil. We are currently at the pre-feasibility stage. Then, with the tolling model, Shalipayco in Junín could also be in production pretty soon.

What are your main areas of work with regard to community relations?

We have a reforestation project in Cerro Lindo, which is located in a very arid area. That is why we use desalinated water for the operation. On top of this, we are working with the communities to create reservoirs. We are also encouraging them to create communal companies, where the whole community (and not just a few families) can benefit from contracts. The idea is to integrate them as part of the production chain of the project. The seed capital required to get going would be the purchase of the land. The environmental footprint of mining projects in the Andes can amount to thousands of hectares, but in Peru the resulting funds from these transactions have not been invested to develop the communities' assets and capabilities. This is a key part of our Michiquillay proposal. Importantly enough, Peru's legislation incentivizes this model, as communal companies are not required to pay income tax. —

Juan Luis Kruger

CEO
MINSUR



What have been the main milestones for Minsur over the last years?

Minsur has undergone transformational changes since the Breca group decided to diversify away from tin. In that context, we put the Pucamarca gold mine into production in 2013, which is one of the lowest-cost gold mines worldwide and has world-class safety and productivity standards. We also made two important acquisitions: Mineração Taboca in Brazil, which includes a tin mine and a tin smelter, in 2008; and a 70% stake in the Mina Justa project in 2012. From being a company with just one mine, today we are present in two countries, we have four mines and two smelters, and one large copper project in the pipeline. Tin continues to represent 75% of our business, but gold already accounts for 15%, while we are also developing our niobium and tantalum production in Brazil.

What are the main facts and figures about San Rafael?

San Rafael is the world's largest and highest-grade tin mine. Today's grade of 2% Sn is half of what we had a few years ago but is still twice as rich as other operations worldwide. In 2015, it was Peru's safest underground mine, as recognized by ISEM. Leaving aside the by-products that other mines may have, we are the lowest-cost tin producer worldwide. Production of tin is 20,000 mt/y, and we have reserves and resources for nine more years.

Could you describe the main projects under way at San Rafael?

The company has always been committed to innovation. In 1996, the Pisco smelter

was the first one in the world to incorporate the top submerged lance (TSL) furnace technology for tin smelting. More recently, over the last six months we have implemented the Ore Sorting project, a \$20-million investment to pre-concentrate low-grade mineral at San Rafael using X-ray. We also have the B2 project for tailings reprocessing. The project will allow for additional production of 5,000 to 6,000 mt/y of fine tin. It will require an investment of \$180 million, and production should begin in 2019.

What is the performance of the Brazilian assets of Mineração Taboca?

The Pitinga mine is the largest tin deposit worldwide, with 420,000 metric tons of fine tin contained, although it is low grade. It is also the world's largest tantalum deposit, while it also has niobium and rare earths. The challenge is how to monetize all these elements. We have been able to separate the tin and to produce ferro-niobium and ferro-tantalum, to have better access to the final clients. In parallel to this, over the last four years we have doubled our tin production. This year we expect to produce 6,000 mt of fine tin in Brazil.

What is your competitive advantage as a formal company with conflict-free tin production?

45 to 50% of the world's tin production comes from artisanal mining in Indonesia, Malaysia, China and Myanmar. The current proposal in the European Union to have a closer supervision of tin sources is not very different from the Dodd-Frank Act in the U.S. a few years ago. It will make it very difficult for certain producers

to reach the final market, so the price of tin should continue increasing. In that context, we have a privileged position, because we are the only tin player that is completely integrated from exploration to the final industrial user. We are 100% conflict-free and 100% traceable along the whole value chain, both in Peru and in Brazil. We have adopted what we call a 'sustainable' commercial strategy. Tin being used in high-technology applications, end users like Apple, Cisco, Intel and Sony are willing to pay a premium for conflict-free tin.

How are tin fundamentals looking from a supply-demand perspective?

The demand for tin is increasing, especially from high-technology applications. Three years ago, there was no tin in batteries. Today, 6 to 7% of the world's consumption of tin goes to batteries, while the use of tin cans still grows significantly in the soft solder business.

Finally, could you give us more details on the Mina Justa copper project?

We have completed the second pre-feasibility study for Mina Justa. We are looking at an open pit mining project with two processes: a heap-leach process to extract the copper from the oxides, and a traditional concentration process to treat the sulfides. The mine should yield between 100,000 and 120,000 mt/y of fine copper, between concentrates and copper cathodes. We are now entering the feasibility stage and we hope to be able to take a construction decision by July 2017. Oxide production should start around 2020, and sulfide production in 2021. *Capex* would be in the range of \$1.2 billion to \$1.4 billion. —

Mark Brennan

President & CEO
SIERRA METALS



What are Sierra Metals' main assets and what have been the latest developments for the company?

Our lead asset is the Yauricocha mine in Peru, while we also have two operations in Mexico: Bolivar and Cusi. At Yauricocha we are past the mid-way point in terms of the restructuring of the mine. We are essentially looking at modern techniques for mine advancement to make the operation more efficient. We are also looking at mining higher-grade areas, while we have recently had a new exciting discovery called Esperanza. We think this has huge transformational capabilities for the company. Esperanza is less than 400 meters from the central mining area and less than 100 metres from the current underground workings at Yauricocha, so we could bring it into production very quickly. At the Esperanza zone we see wider widths, higher grades and we anticipate lower production costs. In Peru you have large systems like Morococha or Toromocho, and we believe Esperanza has potential to actually be very large as well. We are very optimistic. In Mexico, Bolivar has been our second foundation asset; it is basically a copper play, as opposed to Yauricocha, which is a poly-metallic play. We have been expanding production dramatically; from 400 mt/d in 2011 to 2,500 mt/d in 2015, and we are closer to 3,000 mt/d currently. Cusi is the baby in the family; it is primarily a silver asset. We have been developing the project as opposed to having full production there, and in 2016 our anticipation is that we will have more production which, combined with higher silver prices this year, should give us good returns.

How are you improving mining methods at Yauricocha?

Advancement has historically taken place through steel sets. Recently we have gone from 100% steel set advancement to approximately 50% steel sets and 50% shotcrete and bolting. We are looking at using more jumbos as opposed to manual jackleg drilling methods. In other words, we are taking the methodologies out of the 20th century and move them to the 21st century. Yauricocha, because it was privately owned, was not really pushed in that process before. At the central mining zone, as we are getting deeper, we are getting more

water, and with that come stability issues. Most mines become more expensive to operate as they get deeper. What is very nice about Esperanza is that it is adjacent to where we are mining now, and it does not present issues with stability and hanging walls.

How do you expect Yauricocha to perform this year?

During the restructuring, our production will probably be flat. For 2016, we should see production to be above 2015, but we are also moving for higher-grade ore as opposed to just going for tonnage. As we move forward with Esperanza, we will be expanding our production.

What are the main differences between Peru and Mexico to operate mines?

In Peru, altitude is the main issue. Yauricocha is at 4,600 meters above sea level and is not an easy location to do mining. From legal and administrative perspectives, Peru is a very good place to do business. We have not had any issues with the community either. Probably Mexico is more complicated from a legal perspective.

At a corporate level, how do you plan to achieve growth?

Our short-term growth potential is coming from brownfield exploration. Besides Esperanza, Yauricocha has had very little major exploration at the mine, so we see great growth potential to maximize the resources in the immediate areas around it. At Yauricocha we have 18,000 hectares and we have only scratched the surface there. It is a district. We have similar potential at Bolivar and Cusi. So, we do not have to go to the market and compete for new assets, we can grow organically and get a better return on dollars invested.

How do you expect silver prices to behave?

Gold is trading at a higher multiple of silver than has been the case in recent history. Moving forward, I would expect to go back to a gold-silver ratio of 60 or 65, so I can see some good upside on the silver price. I see there is strong demand, in a context of very low interest rates or even negative interest rates. I have a bullish perspective for silver. —

Adolfo Vera

President & CEO
SOUTHERN PEAKS MINING



Why did you decide to sell the Quiruvilca mine?

Quiruvilca was the stepping stone that we needed to be seen as an established mining operator and not just a junior company. Our team was able to deliver a good operational execution, and that was the reason why we were considered by Trafigura when they divested Condestable. Once we acquired Condestable, our flagship operation, we saw that the mine needed some reshaping to survive low cycles like the present one, and Quiruvilca was taking too much attention from our management team. We found an interested group with good financial backing and mining knowledge so we decided to sell the asset to them.

What have been the main achievements of the modernization of Condestable?

Production figures and the quality of the concentrates were always good, but we have reduced costs significantly. We have done that through a combination of operational improvements. The main mining method now, accounting for 60-70% of total production, is sublevel stoping (long-holes). This only represented 15% before. Some areas of the mine cannot be mechanized, but we believe we can reach a mechanization level of 70-to-80%. This reduces the cost per metric ton immediately. Condestable used to be a spread-out operation, now it is much more centralized. The Condestable and Raúl mines are now connected. Also, as a result of mechanization, we have reduced the workforce, reducing safety risks and ensuring that we can be a good employer for the people we have in the current cycle. Today we have cash costs that are very competitive for an underground mine.

Condestable has been running for over 50 years and we continue to find additional resources. Right now, the production rate is 7,200 to 7,500 mt/d. We are looking at cheap ways to expand our plant capacity, because as we become more efficient in our mining methods, we should be able to produce more ore. One of the challenges we have at Condestable is that the rock is very hard. To obtain good recoveries, we need a particle size of around 40 microns. We are finalizing talks with a German company that produces very special mills that are used in the cement industry. The material at Condestable is very dry and is amenable to this kind of milling, which produces very fine particle sizes.

Where does the Ariana project stand today?

In April, we received the approval of our environmental impact assessment, and this is a key milestone for the project. We are working on additional permits to be shovel-ready if we want to move ahead. In the meantime, we are trying to enlarge the resource through exploratory drilling. Ariana is going to be a very low cost copper mine, with very good zinc and gold by-products. Cash costs will be less than \$1 per pound of copper, which is excellent for an underground mine. So far we already have ore for 11-12 years at Ariana, and mineralization is open in all directions.

Do you anticipate any issues in terms of the social license and the access to financing?

We do not anticipate any financing problems at Ariana. We are certainly looking for the most effective financing structure; as long as we can raise debt, we will favor that option, as it is cheaper than equity. We have enough interest from a number of fund providers and therefore we do not think that we will have any problem.

With regard to communities, we have been working with them from the very beginning. This project was initially handled by Teck, then Pan American Silver, then us. Right from the moment we acquired Ariana, our social team was closely involved with the two main communities, Marcapomacocha and Carampoma. We are dedicating funds to promote sustainable economic activities in the area and to support development in health and education infrastructure.

What is your expectation for the copper price over the next months?

At Condestable we have hedges in place that are active this year, so we are still enjoying 2013 copper prices. However, we knew that we needed to reduce costs. We are working towards achieving a C3 cash-cost of \$1.50/lb. If the copper price goes below that, we would be in trouble, but we believe so would the rest of the industry. We do not see prices bouncing back in the short term: China is still a big question mark and copper output continues to increase. However, in the medium term, copper fundamentals suggest a much better price. —

We are looking at using more jumbos as opposed to manual jackleg drilling methods. In other words, we are taking the methodologies out of the 20th century and move them to the 21st century. Yauricocha was not really pushed in that process before.

In April 2016, we received the approval of our environmental impact assessment for Ariana, and this is a key milestone for the project. We are working on additional permits to be shovel-ready if we want to move ahead.



PROJECT DEVELOPMENT AND EXPLORATION



“In 2015 and 2016, the rhythm of mining investments has slowed down, yet we strongly believe that mining is here to stay, at least for the medium term. The portfolio of mining projects is worth \$60 billion. In 12 to 18 months, with just one or two announcements for new large projects, we will be again in a great growth position”.

- Mariela García de Fabbri,
CEO,
Ferreycorp



DISCOVERING ZINC & SILVER IN PERU

Ayawilca New Inferred Mineral Resource (May 25 2016) **Open in most directions**

18.8 million tonnes grading 8.2% Zinc equivalent
(5.9% Zinc, 74 g/t Indium, 15 g/t Silver,
0.2% Lead) (5% ZnEq cut-off grade)

5.4 million tonnes grading 0.89% Tin equivalent
(0.76% Tin, 0.31% Copper, 18 g/t Silver)
(0.45% SnEq cut-off grade)

Colquipucro Silver Oxide Mineral Resource (Feb 26 2015)

14.3 Moz silver (Indicated) & 13.2 Moz silver
(Inferred)

www.tinkaresources.com

Feeding the Project Pipeline

*Project developers and explorers
keep working despite market
challenges*

Total mining investments in Peru were \$7.5 billion in 2015, confirming the downward trend since 2013. This year, the estimate is \$5.3 billion, according to Peru's Central Bank. The only large capital project expected this year is the \$1.2 billion expansion of Southern Copper's Toquepala operation, to go from 60,000 mt/d to 120,000 mt/d.

Buenaventura, that has postponed the construction of its San Gabriel project until 2018, is advancing towards production at Tambomayo, a \$340 million investment that will yield 150,000 to 170,000 oz of gold and 3.5 million oz of silver in 2017. First production should start in Q4 2016.

Other than that, the rest of the year will not see important developments from the point of view of new capital projects. Certainly, the industry will see an enormous increase in copper production thanks to the recent investments, but mining suppliers are already suffering from lower levels of activity regarding projects.

The hiccup is also affecting the exploration segment, although, as in 2009, the impact of the global reduction of exploration budgets is not hitting Peru as badly as in other countries. According to the World Exploration Trends report by SNL Metals & Mining, which covers non-ferrous metals, Peru received 6% of all the exploration dollars spent globally last year. Global investments in exploration dropped by 19% year-on-year to \$9.2 billion, but in Peru the reduction was only around 3%.

This can be explained partly by the importance of underground mining in Peru, where brownfield exploration is constantly necessary to replenish reserves, as well as by Peru's perceived advantages in terms of geology, legal stability and competitive costs for mining development. Nevertheless, overall expenditures are half of what was spent in 2012.

"In Peru there are many underground mines that cannot afford to stop exploring. In general, large and medium sized mines have continued their activities, but if you look at the overall volumes, we estimate that less than 30% of the drilling rigs in the country are working, as opposed to over 80% a few years ago," said Sergio Cepeda, sales director of Boart Longyear's product division in Peru.



Image: Explomin

Gold-Focused Juniors

Companies increasingly look at cash producing models

The lack of funds has seriously hit the junior segment, which has been forced to find new ways of financing as the appetite of investors for equity in risky ventures has vanished. One of the alternatives, pioneered by Dynacor in the 1990s, is the gold tolling business to produce cash flow. Dynacor has recently completed the construction of its second gold processing plant at Chala, which should start operating before September this year at an initial capacity of 300 to 360 mt/d, expandable to 450 and 600 mt/d in the future. "The new mill will allow us to significantly reduce our costs. Firstly, Chala will be connected

to the national power grid, which gives us an average cost of \$0.08 per kilowatt hour (kWh), a third of the current \$0.25 per kWh at our Huanca plant. Secondly, Chala is located only 5 kilometers away from a major highway. This is important for our clients who will be trucking their ore to our facility and will allow us to attract more miners," explained Jean Martineau, president & CEO of Dynacor.

While other companies, such as Inca One Gold, have decided to abandon exploration to fully dedicate themselves to gold processing activities, Dynacor remains active as an explorer, with Tumipampa

► 48

MINES D'OR
dynacor
GOLD MINES

THE MAKE MONEY AT ANY GOLD PRICE COMPANY
Dynacor is a gold ore processing and exploration company active in Peru.
The main assets include 3 exploration properties, the Metalex Mill and the new Veta Dorada Mill in construction.
Dynacor is profitable since 2011.

TSX: DNG www.dynacorgold.com

Jean Martineau

President & CEO
DYNACOR GOLD MINES

What plans does Dynacor have for the new Chala plant in terms of its processing capacity?

The construction of our new ore processing facility at Chala has certainly been the most important development during the past 12 months. We are planning to begin operating the plant at 300 mt/d and will increase this to 360 mt/d as soon as possible thereafter. The plant is designed to be readily upgraded to 450 and 600 mt/d in the future. Furthermore, the new mill will allow us to significantly reduce our costs. Firstly, Chala will be connected to the national power grid, which gives us an average cost of \$0.08 per kilowatt hour (kWh) as compared to \$0.25/kWh at our current mill. Secondly, Chala is located only 5 kilometers away from a major highway, and therefore has the added advantage of easy access for large trucks and trailers. This is important for our clients who will be trucking their ore for purchase and processing at our facility.

How will the new Chala facility affect your Huanca plant?

Once Chala begins production, we will move all the current production there. Huanca will then be used as a pilot plant for Tumipampa, and we will be able to fine tune it according to the metallurgy of the ore.

Tumipampa is Dynacor’s flagship project. How have you advanced exploration efforts at this deposit?

We did a lot of exploration at Tumipampa in 2015. We focused on underground exploration, including excavation of cross-cuts, drifts, raises and drilling. The results that we have published so far are very positive. The main achievement in 2015 was the discovery of a large gold and copper porphyry of 1700 by 750 meters. We are now planning the next exploration campaign. We expect to have a 43-101 report covering the gold and copper mineralized veins and mantos only. We are very excited about Tumipampa, as the results we have obtained so far look very promising.

What is the secret behind Dynacor’s success in generating enough cash from its ore processing facility?

We do not use any special technology. Technology is not the secret. The secret is our team and their expertise. It is important to have a good team going all around the country developing solid relationships with ore providers because many of these are small

artisanal miners. We buy ore from 250 different miners and thus cover the whole country; sometimes we even buy concentrate from Bolivia. We have to be very selective when it comes to ore we choose to process at our facility. It is simple to operate a mill, but when you begin to mix different ores, things can get complicated and the recovery rate can drop. So we carefully monitor the adjustments that need to be made for different types of ore. On top of that, we conduct very precise analyses of the mineralogy of the ore to know how to process it. We have a great team in place that is able to handle this complex process.

How would you assess permitting processes in Peru?

If you ask any mining company in the world about permitting, they are bound to complain about the length of this process. We have had some problems with this lengthy process in Peru. The first permit for construction of our mill was delayed for a very long time. Now that we have the facility in place, we are confident that when we apply for an expansion permit and that the process will take much less time.

What needs to be done on behalf of the government and mining companies to bring fatality numbers down to zero?

At our production site, we have never had fatalities or major accidents. We always comply with all the regulations and in particular the safety and health regulations, which in Peru are very strict and are enforced. We only work with reliable contractors and make sure our employees are safe at all times. Well-trained employees are the most important part of ensuring safe operations.

What are your plans with regards to Dynacor for the next year?

We will be running our Chala facility somewhere between 300 and 360 mt/d. Our Metalex-Huanca mill will probably be used as a pilot plant for ore from Tumipampa. We will optimise our costs and achieve improved profit margins. If the price of gold continues to increase, we will be producing more gold and silver and we will be focusing on expanding the Chala mill. At Tumipampa, in 2017 we will explore the newly discovered copper-gold porphyry and the disseminated zone and should, by the end of the year, have a much better and precise idea of the potential of this discovery. —



Gordon Ellis

Chairman & CEO
LUPAKA GOLD



What is Lupaka Gold's primary focus?

Our focus is on the Invicta project, which we acquired when we merged with Andean American. Prior to the merger, Andean American's vision was to put Invicta into production at a rate of 5,200 mt/d. They obtained all the permits to do so. However, the majority of the mineralization was inferred-only and they determined that it was not reasonable to go ahead with that project. Currently, our objective is to put the project into production as fast as possible and turn the company into one which is cash-flow positive. Within their 5,200 mt/d objective there was a small core of measured and indicated mineralization that could be optimally mined at a rate of around 1,000 mt/d. We are going to start with 350 mt/d. Fortunately for us, our predecessors completed 1,200 meters of drifts that go right to the core of the mineralization, so there is very little development work to be done. Over the last few months, we have already taken out around 1,000 mt of rock as test batches. The material is showing very good recovery rates.

What are going to be the next steps for Invicta?

We have just closed an agreement with Pandion Mine Finance to obtain \$6.1 million, which will be sufficient for us to start mining on a 100% contract basis. As we grow, we want to see how much of the potential 5,200 mt/d target is actually there through in-fill drilling once we have cash-flow. If the material is there, it is fairly easy to expand the operation to 1,000 mt/d in a year or two, because the grade is pretty good. In terms of value, the project is 70% gold, 20% copper and the balance is silver and poly-metallic content. With 350 mt/d, we would be producing around 20,000 ounces of gold per year. If all goes according to plan, we should be in production in Q4 2016. We expect to close financing in a few weeks, and then we would need to close an agreement with the communities to upgrade the road, and to implement a number of safety features within the mine.

If you are successful with the start-up, do you anticipate building your own processing plant?

We have quotes with a number of processors and traders to use our material, as well as with mining contractors to run the operation on a block-by-block basis. We will start initially with a contract processing capacity, but

the benefits of having our own plant would be multiple, including lower shipping and processing costs and control over the whole process. Right now there are a number of processors who are crying for raw material, but if the market changes, that may not be the case in the future. So, within a very short time frame, we are looking forward to building our own plant.

Some other juniors are also moving to small-scale production to obtain cash-flow. What are the advantages you have at Invicta?

Our grade is sufficiently high that, if the price of gold goes down, we can still make money. When we started looking at development, gold was selling at \$1,060/oz and the economics were still good. Invicta has sufficient mineralization to keep going for 10 years at a rate of 350 mt/d. Besides, we can get the operation going with just \$6 million dollars from the upcoming financing deal, and that is a cheap investment to get a company to producing cash flow.

What is the status of your other two projects, Crucero and Josnitoro?

Crucero has 2.1 million ounces of pit-constrained gold resources and good exploration targets to double that. The material is right by the surface and cheap to mine, but it is low grade, so it needs a price of gold around \$1,500 or \$1,600 to be profitable. We are putting Crucero to the side for now. Finally, we have a joint venture with Hochschild for the Josnitoro project. With the change of the government's attitude towards artisanal miners, we believe things have changed in our favor, as the local communities are more likely to be supportive. The project offers high grades of copper and gold.

Are the markets more favorable this year for juniors?

We started looking for funding for Invicta around September last year and it was very difficult. For the initial months of 2016, though, we have had a lot of people knocking on our door, so I would say that the markets are improving significantly. As Lupaka, from an operational point of view, we are going to be in production very soon. From a corporate perspective, production will bring cash-flow, and that will enable us to establish the foundations for the sustainability of the company moving forwards, creating value for shareholders. —

as its flagship project. Martineau summarized the main developments on that front: "Last year, we focused on underground exploration including excavation of cross-cuts, drifts, raises and drilling. The main achievement in 2015 was the discovery of a large gold and copper porphyry system of 1,700 by 750 meters. We are now planning the next exploration campaign. We expect to have a 43-101 report covering the gold and copper mineralized veins and mantos only."

Other companies are making the transition from exploration to small-scale production to secure company funding and profitability. Lupaka Gold, for instance, is already mining ore from its Invicta gold-copper property, where the plan is to start a 350 mt/d operation, expandable to 1,000 mt/d later. At the initial stage, production would be around 20,000 oz Au per year. As part of the process, the company has secured an initial financing package for \$6.1 million, payable in gold. The company expects to use the cash flow from Invicta to advance its other exploration projects, Crucero and Josnitoro.

“It is clear that the traditional equity markets are not at the same level they were four years ago. There has been some recovery, but not a full recovery, and it has been restricted to certain jurisdictions. My experience is that quality projects tend to attract the capital required to advance them. You may have to use a unique sort of financing, but it still can be done.”

- Brian Maher,
President & CEO,
PPX Mining



”

Gordon Ellis, chairman and CEO of Lupaka Gold, explained that they will initially use gold tolling providers: "We will start with a contract processing capacity, but the benefits of having our own plant would be multiple, including lower shipping and processing costs and control over the whole process. Right now there are processors crying for raw material, but if the market changes, that may not be the case in the future."

PPX Mining is also beginning mining activities at the Igor gold project, with the initiation of a bulk sampling and test mining program at the Callanquitos structure for 150 mt/d initially. Using a third-party milling facility, the company expects to gather data on metallurgical recoveries to build its own processing plant next year. For Brian Maher, president & CEO of PPX Mining, a key component to keep the company moving has been the search of unconventional sources of financing: "We are partnering with various providers that give us the tools we need: a mining contractor and a processing plant contractor. On the mining side, our partner is Proyectos La Patagonia; they made a private placement into the company for \$440,000. In a similar model, AM Mining invested

\$5 million into the company, which we used to make a \$3.8 million payment to them for the construction of a 350 mt/d processing facility."

One of the latest players that want to fast-track a gold project into production is Eloro Resources at La Victoria. Led by the team that established Champion Minerals in Quebec, the company is doing geophysics to reconfirm the previous work at the property, while it is planning a 4,000 to 5,000 meter drilling campaign to prove what they believe could be an epithermal heap leachable deposit. The idea is to have an inferred resource base and a preliminary economic assessment complete within a year.

"One advantage at La Victoria is that one is not required to look at raising billions of dollars, but instead, for a heap-leach operation, one could be looking at a \$35-40 million, which is not a big number if you have a proper debt and equity financing model to work with. Alternatively, there is an opportunity to bring in a partner," said Thomas Larsen, chairman and CEO of Eloro.

Eloro's senior mining vice-president, Jim Steel, is confident that the project's location in Ancash, near other mines such as Barrick's Lagunas Norte and Tahoe's La Arena, will translate into a similarly rich deposit: "La Victoria hosts the same stratigraphic succession within the sedimentary rocks as some of the mines around us. The intrusives at La Victoria appear to be lithologically similar to those at La Arena, with the exception that we have higher grades, up to 46 g/mt in oxides and 63 g/mt in sulfides on surface. We also have artisanal miners at La Victoria, who are consistently extracting 4 to 8 g/mt material." —

Thomas Larsen & Jim Steel

—
TL: Chairman & CEO
JS: Senior VP Mining
ELORO RESOURCES



TL



JS

How did Eloro start focusing on the Victoria project in Peru?

TL: Eloro Resources is a resource exploration and development company with a proven management team. The company is listed on the TSX-V. We are primarily after precious metals: gold and silver. We have taken our time to assess projects that we really believe have excellent merit and potential. The Victoria project in Ancash really interested me because of its location close to other mining deposits like Barrick's Lagunas Norte and Tahoe's La Arena and Shahuindo mines. We have a very strong technical team, led by Jim Steel and Dr. William Pearson, while I have extensive experience managing and financing junior exploration and development companies, building on a previous career as an investment broker. In the near past, I was the founder of Champion Minerals, later renamed Champion Iron Mines, for which we raised \$100 million to develop iron ore resources in Quebec. Today, our focus is on the La Victoria property, where we are planning a drilling campaign to prove up what we believe could be an epithermal heap leachable deposit type and, if so, move it to a feasibility study stage over a three-year time frame. We have recently signed an agreement to acquire a 100% interest in the La Victoria property, which is a major milestone to have when you present a project in a foreign jurisdiction to investors. One advantage a project like La Victoria has is that one is not required to look at raising billions of dollars, but instead, as a heap-leach operation, one could be looking at a \$35-40 million capex, which is not a big number if you have a proper debt/equity financing model to work with. Alternatively, once we have 100% interest in the project, there is an opportunity to bring in a partner that has a strong balance sheet after Eloro moves the project up the value curve.

What are Victoria's most attractive points?

TL: What I like about La Victoria is that, if we can demonstrate a heap leach operation, it becomes a highly prospective project and it will attract outside financiers. All-in-sustaining-costs per ounce seem to be in the US\$800 per ounce level if one looks at proximal operations. Exploration dollars are also manageable due to the nature of the topography at La Victoria.

JS: The project is approximately 40 square kilometers. It sits within the major trend of the north-central belt that starts at Pierina and goes through La Arena and La Virgen, as well as Lagunas Norte, up to Cajamarca with Yanacocha. As a mining geologist, I like this project because it hosts the same stratigraphic succession within the sedimentary rocks as some of the mines around us. The intrusives at La Victoria appear to be lithologically similar to those at La Arena, for instance, with the exception that we have higher grades - up to 46 g/mt in oxides and 63 g/mt in sulfides on surface. We also have artisanal miners on La Victoria, who are consistently extracting 4 g/mt to 8 g/mt material.


Have you already thought of the different infrastructure items required for production?

JS: Thanks to the activity by artisanal miners, the rocks are already exposed at Rufina, which is great. If we start extracting rock by the road and go up in a standard pit design, there is little overburden and that could mean a low strip ratio. Mining costs are the same for ore or for waste, so low strip ratios are key; you save a lot of money. We will be evaluating this in the upcoming drill program.

What are going to be the highlights over the next months?

TL: We have to complete the preliminary geophysics work now underway to reconfirm the previous work on the property. This entails an I.P. survey and more detailed mapping for more informed maiden drill targeting information. Once that is completed, I would like to do a minimum 4,000-5,000 meter drilling campaign, so we will probably have to raise around \$1.5 million. Then, the drilling campaign will probably take us to October and then keep us busy with updated technical reporting until year-end.

JS: We want to complete the work required to make the market understand that this is possibly the same type of bulk-tonnage heap-leach deposit that we can see in other mines around our location. We aim to get a resource together, with a continuous body of mineralization at depth that we have seen in surface sampling. Within a year, our goal is to be at a preliminary economic assessment (PEA) with an inferred resource base. —




EXPLORE ELORO'S GOLDEN OPPORTUNITY

Eloro is proud to announce its proposed acquisition of a 100% undivided interest in the La Victoria property, located in the prolific North-Central Mineral Belt of Peru.

TSX-V: ELO

Toll Free: +1.800.360.8006
info@elororesources.com

Tel.: +1.416.868.9168
www.elororesources.com



Andrew Swarthout & Elsiario Antúnez de Mayolo

AS: President and CEO

EA: COO

BEAR CREEK MINING



AS



EA

What is your main focus for 2016 at Bear Creek Mining?

AS: We have two primary focuses: firstly, at Corani we are moving through the permitting phases step-by-step. Now that we have the EISA approved, we can look at having a construction permit in 12 to 18 months. We have also been working on maintaining all our social license commitments with the Corani communities. We do not think the markets are in a position to finance Corani right now, but with improving market and metal price conditions that could change soon. Secondly, we are also working on our Santa Ana arbitration: the final hearing will take place in September. We believe that we have a very strong case that the Government of Peru violated the Canada-Peru free-trade agreement and we feel quite confident about the prospect that we will receive some sort of an award. The arbitration panel does not have authority to force the Peruvian government to return the project to us. So, realistically, we are just looking at a damages award.

In the meantime, what levels of social work have you been doing in the Corani area?

EA: Our CSR efforts at Corani have been consistent over the last decade. We have been working on three main pillars: education, health, and sustainable productivity. Back when we started in 2007, education levels were extremely poor; probably only 5% of the people could read and write. Now, the local Chacaconisa and Quelccaya schools have received educational quality awards for three consecutive years from the Puno region.

In terms of health, we helped reduce newborn mortality rates from 30% in 2010 to less than 5% today through the introduction of nutritional education and medical services, according to official figures. Finally, with regard to the development of local businesses, we have worked on alpaca wool projects, improving the quality of the wool and helping producers export directly to Europe instead of selling locally to traders. Before, they were paid \$4 per pound of wool, and now they can sell for \$70 to \$100 per pound.

A final area of focus is our effort to build a connection between State bodies in Lima and the local communities. We have been successful in this respect, to the point that

the central government is currently implementing sanitation and housing projects in the area around Corani.

How important is the use of dry stack tailings and the elimination of the tailings dam to obtain the social license?

AS: Water was actually never an issue at Corani; in fact, the initial EISA, that included the use of a tailings dam, was approved. However, as we worked on our final feasibility study, we saw the value of using dry stack tailings. This method used to be used only in small mines of 500 or 1,000 mt/d, but Milpo is now using it at a massive sulfide mine in Peru, Cerro Lindo. There are also projects in North America looking at dry stack tailings for operations of 60,000 and 70,000 mt/d, so it is a real technological innovation that we can use to reduce the environmental impact of the Corani project even further. We identified that we could use dry stack tailings from the start of operations, and then mix the tailings with waste materials as of year 6 of the operation and backfill the pits with this mixture. This does a couple of things: you recover a lot more water, and you eliminate the need for a large tailings facility, which requires a lot of sustaining capital to run. We did a trade off to save \$30 to \$40 million of *capex* over the life of the project, although we had to increase our initial capital investment for the extra stripping and the filtration system required.

Expected *capex* at Corani is over \$600 million, which is high for the current market. Did you consider starting smaller, and then expand though cash flow?

EA: We did analyze the option of starting at, say, 10,000 mt/d and expanding to 22,000 mt/d, but for the particular case of Corani it was not an efficient solution. The infrastructure (power lines, access, construction camp) costs remained constant and are the main *capex* component, regardless of size. Additionally, the distribution of high-grade ore at the ore body does not allow for selective mining to support a smaller throughput. Therefore, the greatest value and efficiency are achieved through larger scale mining and processing. Importantly, however, the low cash costs (negative \$0.15/oz Ag) allows for a four-year payback on capital for an 18-year mine life. —

Base Metals Exploration

Anticipating future strong fundamentals

Base metals do not attract speculative money the same way gold does. This, coupled with low mineral prices, has not helped exploration companies involved in the search for metals like zinc, lead and copper. However, investors should keep an eye on a handful of players that maintain a strong position in Peru's exploration segment, even in the current market.

In the region of Pasco, Tinka Resources is analyzing the geology of its Ayawilca-Colquipucro project, where it has just published an updated zinc resource of 18.8 million mt grading 8.2% zinc equivalent, at a 5% ZnEq cut-off grade. Additionally, the company has published its first tin resource on the property, for 5.4 million mt with a grade of 0.89% tin equivalent.

The project is large and diverse because there is also a silver oxide cap on top. Tinka completed 9,000 meters of step-out drilling last year and the plan is to carry out a new 10,000 meter campaign to move towards a preliminary economic assessment phase by 2017. The budget for this year is between \$5 and \$7 million.

Tinka's president & CEO Graham Carman acknowledged that analysts have been anticipating an increase of zinc prices for years, but he points out that the trend is already positive in 2016. "A lot of the existing zinc mines are very old assets with grades going down and costs going up," he said.

Also on the silver and polymetallic spectrum, Bear Creek Mining continues with the arbitration process with the Peruvian government to recuperate its Santa Ana project, while it holds on to its very large Corani silver asset, for which a final feasi-

bility study was completed last year. The study contemplates the use of dry stack tailings at the project, which is not common in operations this big (Corani would have a 22,500 mt/d plant).

Back to copper, AQM has released its latest pre-feasibility study for the Zafranal project, located in Arequipa. AQM, owners of 30% of the project, are the operators. The other partners are Teck (50%) and Mitsubishi (20%). In terms of grade, *capex* required (\$1.6 billion) and production rates (75,000 mt/y over the life of the mine), the project is somehow similar to Hudbay's Constancia, but current copper prices are a key obstacle for development. The pricing assumption of the PFS is \$3/lb Cu, which would provide for a 5-year payback period and an after-tax internal rate of return of 15.9%.

In the northern region of Cajamarca, Regulus Resources maintains its position in the AntaKori project, adjacent to Buenaventura and Southern Copper's Tantahuatay mine and 7 km away from Gold Fields' Cerro Corona mine, in the district of Hualgayoc. The project already has a 43-101-compliant resource of 295 million mt with grades of 0.48% copper, 0.36 g/mt gold and 10g/mt silver.

The short-term challenge is AntaKori's land position, as it intertwines with Tantahuatay's land, but Regulus has recently signed agreements for collaborative exploration with its neighbors. "The location adjacent to an operating mine means that the project is essentially a brownfield opportunity and may be able to be advanced more rapidly than a stand-alone project located far from infrastructure," said John Black, CEO of Regulus. —



**ADDING
VALUE
THROUGH
CONTINUED
DISCOVERY**

Emerging Cu-Au-Ag Discovery

Experienced Team

Proven Track Record

Well-Funded Projects

Portfolio of Additional Properties

Capacity to acquire additional opportunities arising from distressed market



**ANTAKORI INFERRED RESOURCE
(JULY 3, 2012)**
294.8 MILLION TONNES
GRADING 0.48% CU,
0.36 G/T AU AND 93.3 G/T AG

TSX.V: REG

BVL: REG

CONTACT DETAILS

Av. Jorge Chavez No 170, Oficina
No 1001 Miraflores – Lima – Peru
(51) 1-748-0100

1177 West Hastings St Suite 2300
Vancouver, BC Canada V6E 2K3
(1) 604-685-6800

www.regulusresources.com
info@regulusresources.com

Bruce Turner

President & CEO
AQM COPPER



52

“

The authorities probably understand the reality of large projects like Zafranal in the current market, but it is certainly harder to manage the expectations of the communities, because of the construction of very large projects in southern Peru in previous years.

”

What are the main highlights of the new pre-feasibility study (PFS) for the Zafranal project?

If you compare the PFS with the preliminary economic assessments (PEA), you can see no significant divergence from the previous studies, so that is a good sign. The concepts have stayed intact and we have improved on them. The copper content in the open pit has changed very little. From a mine plan perspective, we have taken a fairly conservative stance regarding slope and ramp designs to make sure that this is a very workable open pit. We have also decided to start with contract mining, which is quite sophisticated in Peru. This allows us to begin the pioneering work and the pre-mine stripping with a contractor. You pay a bit more for that, but of course you defer capital. On top of that, this helps us to build a trained workforce for the mine operation. We have quite a challenging topography, so it is good to have experienced miners working on it during the pre-mine period. We have realized that it actually makes sense to continue with a contractor for three or four years into the mine-life. On the concentrator layout design, we saw it was more appropriate to convey the ore down to a lower elevation than try and create infrastructure platforms in steep terrain near the open pit. It is a 3.6 km tunnel. Through geotechnical drilling and mapping we found out that we have generally good volcanic rock in the area, so it should be fairly inexpensive to build that tunnel, and this way we eliminate other earthmoving expenses associated with access and steep topography in the area. We have a good concentrator design; Ausenco already has experience building such plants in Peru. It is an open air plant, with minimal overhead cranes and no walls or roof; it is built for purpose and has easy access for maintenance.

What are the main aspects in terms of water access and water management?

We went through the process of confirming the location of the tailings management facility (TMF). We looked at four or five alternatives and finally came back to one we already had. We continue to work on this, but we believe we already have an attractive option for the tailings. With regard to the water supply, we focused on finding water that is not suitable for agri-

culture or human consumption. We looked at groundwater and saltwater options. Obviously groundwater is more attractive from an operating and capital cost point of view. We looked at sources of brackish water in river delta areas along the coast. We also looked at collecting fresh water from the Majes valley during flood conditions, but that became unfeasible because we had no convenient place to store it, and the cost of creating storage became excessive. Finally, we found a large quantity of brackish groundwater under an irrigation area. Subject to the approval of the local communities, we could extract a small portion of this water for the operation. We also found brackish groundwater close to the TMF, so we may end up with more than one water source.

What is your relationship with the regional government in Arequipa, and how do you expect to work with the new national administration?

The regional authorities have been very supportive. All they ask is that we do things right and establish good communications with the communities. The authorities probably understand the reality of large projects like this in the current market, but it is certainly harder to manage the expectations of the communities, primarily because of the construction of very large projects in southern Peru in previous years. Because of our grade and size, we cannot afford to be as generous as other mining companies. People have to be patient.

The Humala government has been quite favorable for mining, as shown by the number of developments we have seen over the last five years. If that trend continues, Peru will have a great future in developing these sorts of projects.

After the PFS, what are the next steps for El Zafranal?

At today's copper price, the project is not viable, but at \$3/lb Cu it is viable and quite attractive. The decision depends a lot on how our partners view the copper price and the copper market going forward, but there are indications that an improvement is not going to be too far off. Below \$2.50/lb, I do not think any mining investor is going to develop a project like Zafranal, but we are optimistic about the copper price. —

John Black

CEO
REGULUS RESOURCES



“

AntaKori is located next door to the operating Tantahuatay gold mine. This means the project is essentially a brownfield opportunity and may be able to be advanced more rapidly than a stand-alone project.

”

Could you update us on the most recent developments at Regulus Resources?

The last few years have been tough for the mining industry all around, but at Regulus Resources we made the best out of these times and found an opportunity to acquire an exciting new project. In late 2014, we acquired the AntaKori copper-gold-silver project in Peru by way of a friendly merger with Southern Legacy Minerals. Regulus Resources was formed as a spin out when First Quantum Minerals purchased Antares Minerals, our previous company, in 2010 to acquire our Haquira porphyry copper discovery in southern Peru. The Haquira discovery worked out very well for our team and our investors, however we feel that AntaKori has potential to be even better. We were very cautious when we were looking for another opportunity to make sure that the project had very good chances of going forward. We used the lessons we learned with Antares about what makes a good project and how to get access to capital to keep it going. Many of these factors are non-geological, including social setting, infrastructure, access to capital etc.

What made the AntaKori project an attractive prospect for Regulus Resources?

Our strategy was to look for financially stressed exploration companies with great projects, particularly if those projects showed potential for a significant unrealized upside. While it was fairly easy to identify companies with cash problems, finding a great project was much more difficult. After nearly a two-year search, we identified the AntaKori project, held by Southern Legacy, which perfectly fit our criteria. After amalgamation of our companies, which went very smoothly, we were able to combine Southern Legacy's exciting AntaKori project, well-established local presence, and strong legal team, led by Fernando Pickmann out of Lima, with our experienced technical team, track record and access to capital. It was a very synergistic merger.

The AntaKori project is a large copper-gold-silver skarn with a gold-silver high sulfidation overprint and size characteristics to be explored as an opportunity for a large open pit mine. The inferred resource that we can currently report, based on a NI 43-101 report, which Southern Legacy completed prior to the merger, is 295 million metric

tons at 0.48% copper, 0.36 g/mt gold and about 10 g/mt silver, within ground controlled by Regulus. This is a very good starting point and the mineralization is open in all directions except up. We feel that these results indicate the type of mineralization we can expect, but the size of this project will most likely increase substantially with further work. We are probably looking at a 3 to 5 year drilling campaign with 80,000 to 100,000 meters of drill core, just to get to the point to identify how big the deposit is and where exactly it is. The mineral tenement situation is complex with intersecting land holdings, so drilling depends on arrangements with our neighbours.

AntaKori's close neighbour is the Tantahuatay gold-silver mine. What challenges and opportunities does this present for Regulus Resources?

AntaKori is indeed located immediately next door to the operating Tantahuatay oxide heap-leach gold mine. At AntaKori we are exploring for copper-gold-silver sulphides in basement rocks below the oxidized gold-silver ores in overlying volcanic rocks at Tantahuatay. Our land position is complex and intertwined with some of their land. The target that we are looking for extends onto their land as well. We have been working on agreements to see if we can collaboratively explore the area. Although the complex mineral tenement situation will require additional coordination with neighbors, the location adjacent to an operating mine means that the project is essentially a brownfield opportunity and may be able to be advanced more rapidly than a stand-alone project located far from infrastructure.

Regulus Resources has a dual listing on TSX and the Lima Stock Exchange. How does it help you to raise funds?

Southern Legacy already had a listing in Lima and the way we structured our merger was by way of an amalgamation so that we could preserve that listing. To us it was a nice benefit that came out of the merger. The Lima listing offers several advantages for us. First of all, we give access to Peruvian and Chilean investors to invest in our project, opening doors for additional investors in Regulus. Secondly, we believe that it is an important symbolic step to highlight our commitment to Peru. —

53

Graham Carman

President & CEO
TINKA RESOURCES



54

“

Our silver resource has short of 30 million ounces; it is not so big, but could be a nice start-up pit scenario, and it is a space to watch considering how silver prices are behaving this year.

”

What are the latest developments for Tinka Resources?

We are still focusing on Ayawilca, where we have just updated our zinc resource, now including 18.8 million mt at 8.2% zinc equivalent. Over the last year, we completed 9,000 meters of step-out drilling and we also found a fair amount of tin: we defined a tin resource of 5.4 million mt at 8.9% tin equivalent. With the exception of Minsur, you do not see any other tin resource with the grades we are finding. Moreover, we have a silver oxide cap on top of this deposit. We have not done much with the silver over the last 12 months, but it is definitely an important component, because the silver price is recovering. Also, our team found some high-grade sulfide zones on a cliff nearby, which could be connected to Ayawilca because it is only 2 kilometers away. The area is called Yanapizgo, and we are going to carry out some geophysics there. Additionally, we found a new zone to the north of Ayawilca, 10 km away, with sulfide occurrences at surface. With all this we are working on our regional geology. We have a land package of 150 square km and we are going to fly the whole area to do geophysics.

What is the process to obtain the permits to do all that?

We only have 25% of our area fully permitted, so we are requesting the communities to expand our access agreement to cover a larger area; we also need to expand the scope of our original environmental impact assessments (EIAs). We want permits to be ready for the second half of this year, in order to do a substantial drilling campaign of over 10,000 meters. With this, we could be in a position to start a PEA in 2017. Our total budget for 2016 is between \$5 and \$7 million. We currently have \$5 million in the bank and we will need to raise money at some point.

How do investors perceive zinc?

The zinc fundamentals are very good. I know we have been talking about this for years, but inventories are falling and mining supply of zinc is decreasing with operations shutting down. Perhaps the new upward trend has already started; the price of zinc has rebounded nicely over the last months. Ayawilca is one of the very few

decent zinc projects with size potential. There are some projects in difficult locations in the Arctic and Greenland, but there are very few projects coming online within mining belts with good infrastructure. A lot of the existing zinc mines are very old assets, with grades going down and costs going up.

What importance do you accord to your silver and tin potential?

The silver resource has short of 30 million ounces; it is not so big, but could be a nice start-up pit scenario, and it is a space to watch considering how silver prices are behaving this year. With regard to tin, Minsur has a tin refinery in Peru, so there is a ready market for it thanks to the high grade we have. Our tin layer is underneath the zinc but it is a flat body, so once you get down there, the mining costs would be competitive.

Who are your main shareholders?

We have good shareholders behind us, including the Sentient Group from Australia, who own 21%. Last year we also had the IFC of the World Bank coming on board. They are being very supportive, and this participation gives us a tick in the box for many investors in terms of the social aspects. We committed to comply with certain standards that are not onerous but are certainly above the norm. We have six full time community officers, and a good relationship with the three communities around our area.

Has the famous *permisología* problem improved in any way over the last year?

You still have a lot of red tape. You need the water permit, the environmental permit, the community agreement and the archeological permit; and then you need to put all these permits together to ask for another one to initiate activities. It takes time, and in the junior business time can be a killer. In the best-case scenario, it takes 9 to 12 months to be able to start working. This is probably why there are so few juniors in Peru today. Back in the 1990s, you could just drill a hole without asking anyone for permission, and that was not correct; today we have gone to the other extreme, so we would need to strike a balance. —

Phosphate Potential

Non-metallic mining puts the coast of Piura on the mining map

Not everything is metallic mining in Peru. By the coast in Piura, close to Vale's large phosphate operation, several companies are advancing other sizeable phosphate ventures. One of them is Fosfatos del Pacífico, a subsidiary of local company Cementos Pacasmayo, that plans on producing 2.5 million mt/y of phosphate for 20 years. "We have 400 million mt of resources so

we could build a much larger operation, but 2.5 million mt/y is the amount covered by our off-take agreement with Mitsubishi. It is a large project that requires building a port, a transmission line, water supply infrastructure and an industrial road," said Humberto Nadal, CEO of Cementos Pacasmayo. Meanwhile, junior company Focus Ventures has published an updated pre-fea-

sibility study for its Bayóvar 12 phosphate project, where it plans to produce direct application phosphate rock fertilizer (DAPR), with grades of 24 and 28% P2O5. The new study contemplates an initial capital expenditure of \$168 million, a 20-year mine life and a payback period of less than four years.

David Cass, president of Focus Ventures, highlighted the project's key advantages: "Two key points for Bayóvar 12 are logistics and simple geology. Being a bulk commodity, a location close to tidewater and access to international markets is a big advantage compared to many phosphate deposits. The current resource is considerable: with only 30% of the property drilled to date, there is excellent potential to expand the mine life well beyond the 20 years outlined in the PFS. Finally, the project's location in desert away from major communities should allow for a straight forward environmental permitting process and project development." —

55



CHAMBER
OF COMMERCE
CANADA-PERU

MEMBERSHIP

JOIN OUR NETWORK AND HAVE ACCESS
TO NEW AND EXCLUSIVE BENEFITS




EXCLUSIVE DISCOUNTS
CONTRIBUTING TO YOUR TRAINING



SYNERGY CREATOR
REPRESENTING YOUR INTERESTS



COMMUNICATION PLATFORMS
CONTRIBUTING TO YOUR BRANDING




NETWORKING
IMPROVING RELATIONSHIPS



B2B MEETINGS
SUPPORTING YOUR
COMMERCIAL STRATEGY



TRADE MISSIONS
CONNECTING PERU AND
CANADA



AUDIENCE MEDIATOR
SPACES FOR YOUR EXPERTS



EXCLUSIVE INFORMATION
USEFUL AND VALUABLE
INFORMATION

WWW.CANADAPERU.ORG

David Cass

President
FOCUS VENTURES



What were the results of your Pre-Feasibility study for Bayóvar 12?

The Bayóvar 12 project near Piura will be a truck-haul phosphate mine that will make a natural phosphate fertilizer on site by a simple process of washing and upgrading using seawater. We recently published an updated pre-feasibility study in June, which was a change in scope to an earlier study completed at the end of 2015. The new study focused on the mine plan and process plant. The result was a vastly improved project with an IRR of 26% and NPV7.5 of \$458 million, a result of a 25% reduction in operating costs. Several key components contributed to the improvements: firstly, the mine plan was simplified, and earlier progressive back-filling of the pit reduced the amount of waste stored in ex-pit dumps and minimized the haul distances of the mine trucks. Secondly, investment in more initial pre-stripping allowed us to access all of the phosphate beds sooner and, therefore, reach nameplate production capacity in year 2, in contrast to year 4 in the old study. Thirdly, the mine truck fleet was re-equipped with larger boxes to take advantage of the relative low density of the diatomite waste. The end result was an overall decrease in mine *opex* from \$52/mt to \$39/mt. The new study also highlighted areas to improve costs further at feasibility stage, such as the use of energy-efficient continuous mining systems for overburden stripping and recycling of process water in the beneficiation plant.

Where do you stand in terms of financing?

Our preferred option for financing is through a partner, because it is going to be tough to do a large equity raise in the current markets. We repaid \$1.5 million out of the total \$5 million loan we took from Sprott to acquire the 70% stake in Bayóvar 12, and one of our priorities is to either extend the remaining loan or repay it through alternative financing when funding the bankable feasibility study. We have attended several fertilizer conferences and, although the retail market has been tough, we have seen interest from longer-term resource and mining funds in London and Toronto, as well as from specialized fertilizer companies. In terms of our product market, Brazil and the oil palm industry in South and Central Ameri-

ca and South-East Asia are key. Just lately, we have also seen encouraging developments in the revitalizing of the Argentinian fertilizer industry, where phosphate-depleted soils would benefit greatly from a slow-release natural fertilizer such as Bayóvar 12's.

What are Bayóvar 12's key advantages?

Phosphate is a bulk tonnage commodity so the key thing for us and for other phosphate projects is logistics. Some development-stage phosphate projects are in the middle of nowhere, which is a big negative; if you produce bulk material, you need to be on or close to the coast, with access to a port. That is our number one advantage.

The other advantages are the nature of the deposit and the product itself. We are planning to mine sedimentary phosphate, which is soft and very easy to exploit and process, similar to a sand deposit, with no drilling and blasting required. We mine individual phosphorite layers using selective surface miners and send ore to the processing plant, which is a simple washing operation. Bayóvar rock is arguably the most reactive in the world, which means it is ideal for use as a direct application fertilizer and particularly suited to the slightly acidic Latin American soils.

The resource itself is very big. There is lots of room to expand the mine-life, particularly considering only a third of the concession has being drilled to date. We have one of the most significant discoveries in Peru of the last 10 years and, owing to the simple geology and excellent logistics, we are proud to have achieved completion of a pre-feasibility study within two years of drilling the first drill-hole. Finally, the concession is in the middle of a coastal desert and there are no communities close by to the site.

What are the fundamentals for the fertilizers market?

The key players in phosphate are the United States, China and Morocco. Right now, the market for phosphate rock is about 220 million mt per year. Morocco has the largest resources, but there are other players coming online with new mines, like Jordan and Saudi Arabia. Indian consumption is the key factor affecting global consumption, otherwise it is a pretty stable market. —

Humberto Nadal

CEO
CEMENTOS PACASMAYO



As a cement group, why did you decide to enter the fertilizers sector?

We are not in phosphate because we made a big strategic decision to move into that business. In 2007, we obtained a concession from the government for diatomite, which is a minor component in the cement industry, and the drilling activities there confirmed that there was 400 million metric tons of phosphate rock. We were not that surprised because we are located right next to Vale's Miski Mayo mine, and geology does not follow human boundaries. We are a conservative group in terms of taking risks, so we analyzed the project parameters, including mining, the industrial processing and the commercialization. In terms of mining, a phosphate rock operation is quite straightforward; the same goes with the industrial process. However, as a cement company, we were not comfortable with the commercialization of phosphate rock, so we launched a process to acquire a partner with the relevant expertise and, just as importantly, with the willingness to buy our product. In 2011, we signed a deal with MCAP (Mitsubishi Corporation & Zuari Company) whereby they acquired 30% of the project and signed a 20-year off-take agreement with Mitsubishi Corporation. With that agreement in place, we started working heavily on the basic engineering and, in December 2015, we finished the feasibility study; we also have all the permits needed at this stage.

What is the current status of the project?

We could move fast and invest right away, or perhaps look for another partner with phosphate rock production expertise. We

are defining what the best option for our shareholders is. It is a very particular situation, because this is a fertilizer asset and we are a cement company. I think sooner or later we will spin Fosfatos del Pacífico off; the question is to decide when we do it in order to capture the most value.

Could you go through the main facts and figures of the feasibility study?

Right now, we are looking an annual production of 2.5 million mt/y of phosphate rock. We have approximately 400 million mt of resources so we could build a much larger operation, but 2.5 million mt/y is the amount covered by the off-take agreement with Mitsubishi. It is a large project that requires building a port, a transmission line, water supply infrastructure and an industrial road; this is already included in the *capex*.

What is the impact of phosphates for the Piura region?

Back in the 1950s, geologists and engineers were already talking about the Bayóvar area, so we did not discover anything new. The issue with Bayóvar is that the government always wanted to develop this huge petrochemical and industrial pool, which never saw the light because it was too big. With Vale now operating their mine and a project like ours, the area is developing. Piura is a fast-growing region where we just built a new cement plant. We employed 5,000 people during the construction phase, although during the operation we will not have thousands of jobs. We are honest with the communities: we will create some good jobs, we will bring taxes, we will bring good safety

practices, and we will be a contributor to the development of the Sechura area. Reynaldo Hilbck is an outstanding regional governor: he is really trying to bring development to the region and we are very supportive of his work. We are going to see agriculture, fishing, phosphate production, cement production, oil refining... Piura is definitely the best bet for this country over the next five years.

As a Peruvian company, what are the cultural barriers to work with a Japanese partner?

We have big cultural differences with our partners, but this is absolutely fine. Peru needs both local and foreign investment. Nationality is not the issue: it is about working together, bringing financial resources and expertise that can support the development of the country. Hopefully, 10 years from now people will look at Piura and they will say, 'this worked'.

Could you summarize the next steps for Fosfatos del Pacífico?

Once we make a major investment decision, which could happen already during 2016, the project will take three to four years to be built. We have seen huge cost overruns in the mining sector, and that keeps me up at night. We are doing everything by the book; we will not cut corners, so we expect to be successful. We just finished our cement plant in Piura on time and under budget, and for Fospac we expect to work under the same principles. —



ENGINEERING & CONSTRUCTION



“One thing that needs to be considered and well thought when developing a project is to be disciplined and respect the due process; too often, especially during high prices times, there is a temptation to cut corners and fast-track a project with the intention to save money and accelerate the start up. It has been repeatedly proven that, this way, projects end up costing more, taking longer to be built and not meeting the expected quality.”

- Federico Schwalb,
General Manager,
BISA

Image: Las Bambas (MMG)



Engineering

The new focus on opex-related projects

Companies dedicated to the development of mining projects in Peru have faced a very particular situation this year. On one side, low metal prices have discouraged new investment decisions in the mining industry. On the other, the general election has left in a limbo those projects that were paralyzed by social issues, such as Conga and Tía María, at the same time that public spending in infrastructure projects (roads, ports, etc) will only be reactivated over the next months by the new government. More specifically in mining, the reduction of backlogs has already hit the main engineering houses. In the words of Mario Marchese, general manager of Hatch: "Commodity prices are still low, so mining companies are cash-constrained. The question today is, 'how do we produce more without investing in new equipment?' Most of these efficiencies are achieved through debottlenecking and changes in the circuits that do not represent new capital expenditures." Marchese pointed out that Hatch's project team had to downsize to adapt to the new market, while their services in operational performance have continued to grow in recent months, to the point that they already represent 50% of the revenue in the Lima office. This has only been achieved by offering more competitive rates, though: "Mining companies have significantly adjusted their staff. Many of the people that left mining producers or companies like us have become independent consultants, who can offer services at very low costs, because these type of optimization projects do not require to be bankable." Local engineering company Buenaventura Ingenieros (BISA) is also focusing on project optimization processes to help mining companies reduce costs. Federico Schwalb, general manager of BISA, sees a clear window for the company in this market: "Mining companies are cutting their technical and continuous improvement teams because they do not have the critical mass to justify having these people in-house. This is where we see an opportunity

“

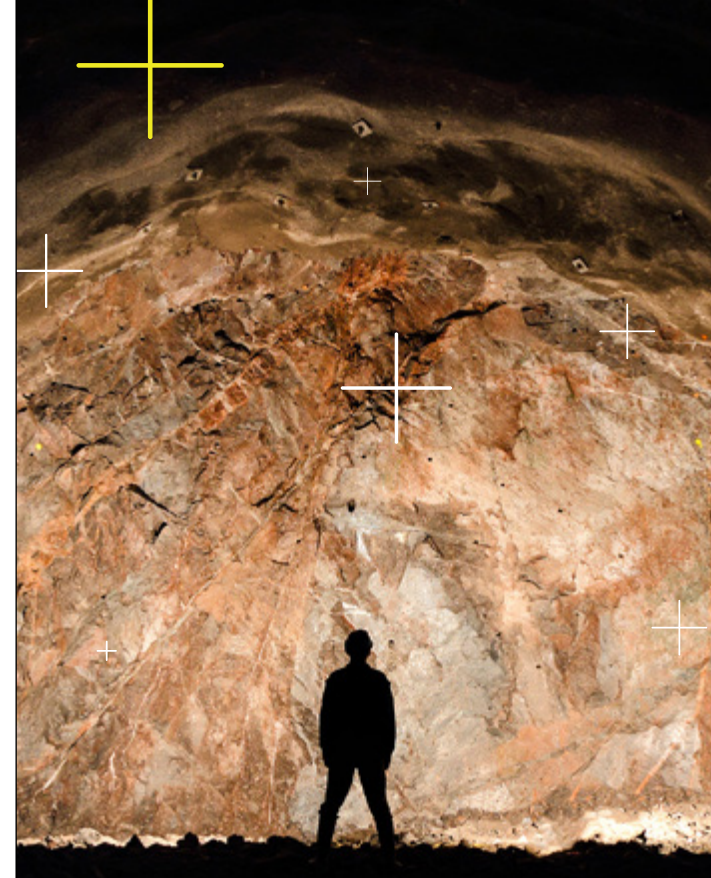
The same mindset that got you into the problem will not get you out of the problem. Mining operations are generally silo-based, while we propose to look at the whole business cycle. Often, due to the key indicators used for separate silos, the optimization of one silo, although to the benefit of that process, may in fact have a negative impact on the whole business chain.



- Matthew Dorman,
Manager Latin America,
Whittle Consulting

”

for BISA: we can become the technical support team for the different mining operators. From a mining company's perspective, they only have to pay for the hours we dedicate to a particular project." Because these projects are smaller in nature, consultancy companies need to rely on a larger number of shorter projects to maintain healthy levels of cash flow: "During the boom years in mining, work flowed our way. Now it is us who need to go out and sell our services, and it is not a simple process for consultants. We need new business development skills that were not needed two years ago," said Alberto Coya, general manager of MWH, an international consultant specialized in wet infrastructure. Coya underlined the difficulty of planning in advance when clients are focused on the short term: "There is not one single mining company that can tell you openly how much they are going to invest this year in their different projects. They are not necessarily secretive about this. In most cases, they just do not know these numbers. They are handling cash flow quarter by quarter, deciding what they can do and what they cannot." As consultancies need to sell more man-hours in smaller projects, expanding the service offering helps maintain a constant relationship with clients. Sometimes this is achieved through strategic partnerships and M&A activity. MWH, for instance, was acquired by Stantec earlier this year. At a more local level, SVS Ingenieros has fully rebranded as SRK Consulting, following the merger between the two companies in Peru. Antonio Samaniego, director of SRK, explained that after a very slow start of 2016, activity is now picking up: "There is a need for new projects along the chain, with PEAs and pre-feasibility studies. We have made sure to keep our team of qualified persons that can sign off these studies in order to be bankable. We have worked a lot with different local and international banks in due diligence processes; this line of business has seen good growth thanks to our merger with SRK." —



+

We embrace your vision as our own.

Your challenges are transforming the way you do business. We understand that your needs are changing rapidly and that you need a partner who is proactive in identifying the larger, long-term issues affecting your business.

Welcome to a new era. Together we can build positive change.

Contact us at hatch.com.pe

HATCH

Mario Marchese

General Manager
HATCH



What is the importance of optimization projects for Hatch?

All companies are cutting costs and trying to optimize their operational expenditures. Commodity prices are still low so companies are cash-constrained. The project teams within the mining companies are now down to four or five people in many cases, whereas they used to have large groups. The question today is 'how do we produce more without investing in new equipment?' Most of these efficiencies are achieved through debottlenecking and changes in the circuits that do not represent new capital expenditures.

At Hatch, our in-house projects team has downsized to adapt to the current market conditions, while our operational performance team has continued to grow in recent months and today represents more than 50% of our Lima office. We are working with several mining clients in Peru and around the world: our local staff is providing support to clients in Australia, Chile, Canada, and the Middle East. We are helping with maintenance, debottlenecking, and operational strategies. We have people based in the mining operations on a day-to-day basis, identifying opportunities for improvement.

With all the people that have been let go, is it easier to find professionals?

Mining companies have significantly adjusted their staff and are relying increasingly on consultants and third parties, which has opened the market to new competitors. We see equipment suppliers coming in and offering optimization services together with their support packages. Also, many of the people that have left mining producers or companies like us have become independent consultants, who can offer services at very low costs, because these type of optimization projects do not require to be bankable.

Do you expect the copper price to remain low for the foreseeable future?

Copper is dependent on Chinese demand. Some people say that the next big driver of copper demand will be India, but this is not going to happen. China is the country that is going to continue driving consumption. The demand from China is now driven by exports, rather than internal demand, and their main client is the United States. Ultimately, everything depends on how the American economy is doing.

How well prepared is Peru to be competitive in a durable, low-prices scenario?

Chile's copper production is stagnant. Mines are very old, and production costs are high. There are a number of projects that are in the pipeline in northern Chile, but they have major issues with community relations and power and water shortages, which decrease their competitiveness. Peru has cheaper labor costs than Chile, the necessary infrastructure is being developed and the regulatory framework is clear and stable, offering investors the necessary elements to ensure their capital expenditures are safe.

There are a few projects in the pipeline, apart from the ones we all know such as Quellaveco, Tia María and the expansion of Toquepala. There are others such as La Granja and Michiquillay. These have been studied for long enough and should go forward. What they need from the government is clear rules and a quicker permitting process. To give an example, to build a hydro-power plant you need between three and three-and-a-half years before you can move dirt, but investors cannot wait for that long without any revenue. The mining sector is similar. In the last competitiveness report from the World Economic Forum, the area in which Peru had its worst ranking was bureaucracy.

Gold production increased in Peru in 2015, but it continues to have a significant amount of illegal output. What is your view on this matter?

Peru is one of the world's largest gold producers, and 20% of its production is illegal. We may not have the same restrictions that blood diamonds have in Africa, but there are concerns about this problem. Some buyers may not want to buy gold if they suspect that it is illegal. The environmental damage caused by illegal gold extraction in the area of Madre de Dios is enormous, so at the same time we are putting Peru's environment and its vast biodiversity in danger.

What are the prospects for Hatch in Peru?

Peru is certainly an attractive market for Hatch. We see ourselves growing strongly in the mining sector. This year we will be able to keep our staff and to grow, with the idea of having a strong team to be ready when the investment projects return. —

Antonio Samaniego

Director
SRK CONSULTING PERU



How has your service offering expanded with the merger between SRK and SVS?

In January 2016, we rebranded as SRK Consulting Peru. We are basically the same company with the same directors, but with more opportunities to work internationally. Besides geology and geotechnical work, we are also active in resource definition, mine planning and modeling. We were already active in mine infrastructure before, and we are steadily expanding our expertise in mineral processing, where we have the support of our Denver and Vancouver offices. We continue to be strong in environmental and permitting. Finally, we continue to have strategic alliances for energy projects.

SRK has 50 offices around the world and a track record of more than 40 years. With that expertise and network, when we have very specific requirements we can have access to previous experiences. Recently, a client in Central America asked us for a ventilation project with refrigeration, and that is an area where our South Africa office has extensive experience. Every office has its own specialization. Our Cardiff, Vancouver and Denver offices are very strong in due diligence. Our experts in Australia are recognized for their tailings expertise. Our Toronto office has great capabilities in resource definition. In Lima we are very strong in environmental, geotechnical and rock mechanics. We are also the strongest office in Latin America for tailings. Our Brazil office is strong in mineral resources, while our Argentina office has more experience in infrastructure, and our Santiago office has a great track record in open pit mining. Here in Lima we have more expertise underground.

Who are your main clients?

One of our main clients in Peru is Milpo. We are working on their integration of Atacocha and El Porvenir, and also on conceptual studies for their development projects. We are also doing projects for Minsur at Marcobre and San Rafael. In past years we were very active with Hochschild for Inmaculada. For Poderosa we work in tailings management. Then, we also do work in the junior segment, mainly for M&A activity.

How can mining companies ensure all boxes are ticked before they embark on a large capital investment?

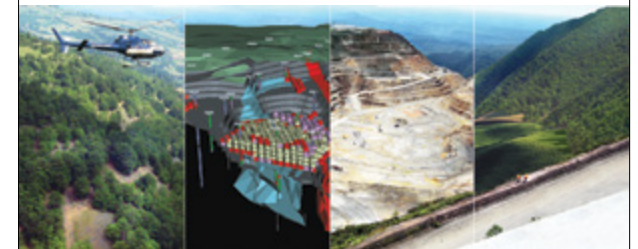
Mine planning is essential. When you cut corners and skip some studies, you may have problems. It is important to work on the geo-metallurgy because it may make sense to separate the concentrates or treat the ore differently depending on the different areas of the mine. Sometimes you have complex metallurgy, like in Toromocho. Initially they thought the deposit was a porphyry type with homogeneous metallurgy. In the end, it had skarn particulari-

ties, and this is why they encountered problems because the very large equipment they had acquired was not adapted to the geo-metallurgical needs of the deposit.

How can universities support the industry?

Today, there is equipment in the country to do the relevant studies and find out if the copper is associated to other minerals or pollutants. Universities have money from the canon, but have limitations to give it to researchers because it can only be used to buy equipment. There, the law needs to change. Also, mining companies think these projects would take too long using the university route, so they use a foreign laboratory instead. There is a need for a closer relationship between the universities and the mining sector. An important effort is being made by CONCYTEC to encourage the creation of centers of excellence in universities, companies and others institutions such as the IIMP. —

Cradle to cradle



Exploration, feasibility, due diligence, engineering and operations through to mine closure.

Our global experience gives you expert, integrated solutions on every phase of your mining project.

Same team — start to finish.

srk consulting

>1,400 professionals • >45 offices • >20 countries • 6 continents

www.latam.srk.com
T: +511 206 5900
E: karindr@srk.com.pe



Federico Schwalb

General Manager
BUENAVENTURA INGENIEROS

their technical and continuous improvement teams because they do not have the critical mass to justify having those people in-house. This is where we see an opportunity for BISA: we can become the technical support team for the different mining companies.

What is the challenge of striking a balance between the depth of studies and the need to start production?

Today, the different phases of a project are more intertwined. In the bonanza years, you could have independent segments within the companies. One typical mistake is to maximize mining production and optimize plant production separately. If, by maximizing mining production, you deliver bigger rock sizes to the plant, the final process may incur in higher costs. What matters is the mine-to-mill results. Then, you can even go backwards, having a better knowledge at the exploration and mine design stages. Having said this, a balance is needed. Yanacocha started production in 1993 with 1.3 million ounces in reserves and a plant for 150,000 oz/y. Today, Yanacocha has produced over 50 million ounces, so you could question why in 1992 they decided to go ahead with a small plant. It is fair to say that it would have been very difficult to find the funds to carry on exploring for another 10 years. In copper projects, however, you are talking of much higher capital expenditures, so companies take a longer time to make a construction decision.

How would you describe the pool of engineers available in Peru?

Today, due to the slowdown, you have engineers available. Having said that, if you want to find a manager with a good engineering degree, good experience, managerial skills and years ahead of him to develop his career (therefore in the age range between 45 and 55), you will have a hard time. There is an age gap in the market. This is because in the 1980s the mining industry had very low years globally, and also in Peru we were in the middle of terrorism. This was the situation since the startup of Cuajone in the 1970s to the commissioning of Yanacocha in the early 1990s. The people you find are either too old or too young. Young people have only seen the bonanza years, so most of them have not worked under severe cost-reduction pressures. Therefore, what I see is that grey-haired professionals are coming back. —

What windows of opportunity do you see in mining?

Today, the focus of BISA is on helping its clients reduce costs. There are not many new projects out there, but there are a lot of optimization opportunities related to the operations. Also, mining companies are cutting



Víctor Anyosa

CEO
EPCM EXPERTS

How is EPCM Experts doing?

We have been consolidating our capacity over the last seven years, growing our expertise in engineering and plant integration, together with all the services that a mining operation requires, including energy environmental control systems, construction and project management. There are no Peruvian companies dedicated to project management; there are large players like Fluor and Bechtel, but we are a great alternative for clients that want to develop their projects of up to \$500 million. We have also developed an environmental division. We know that the market is slow, although we can see signs that it is already recovering, especially in precious metals. We need to be very creative to optimize processes and minimize any negative environmental or safety impacts. In any operation, there is always room for improvement, in areas like water, energy or chemicals usage. Unfortunately, companies only apply creativity when they are under stress.

Juniors are moving towards small-scale production to generate cash flow. Are these projects a good opportunity for you?

Juniors are finding it very difficult to get financing, so we can be innovative and design portable processing plants. We are working

on this in our engineering laboratory. When you have a small deposit, the numbers do not justify building a large plant, however the company may want to maximize the returns over a shorter period of time. This is where portable plants, fully integrated to comply with all environmental requirements, could make sense, as they could be used by different companies.

What is the importance of project integrators?

When companies try to reduce costs, they loosen their control over all the information around the project, like the studies and the engineering. When they decide to do small, isolated projects, very often they forgo the engineering. When that happens, three years later they may find things that have been built within the operation but they do not have any reference of why they are there. Future expansions may cost more money because of this. My message to mining companies is that they should not lose control over their assets, and that they should not stop doing engineering.

There is a lot of talk about mechanization in underground mining. How much more needs to be done?

I do not think Peru is advancing much in terms of the mechanization of underground mining. The main obstacle for this is that a mine requires specialized consultants to support it in all the required processes. Underground mines typically do not engage in systematic optimization procedures and the emphasis on engineering and data analytics is low, both in Peru and internationally. With good data analytics you could reduce costs by 10%, but in order to implement this successfully, you need professionals with a different profile.

What are the prospects for EPCM Experts?

We want to consolidate our work with current and previous clients like Minsur, Hochschild and Antamina. I am optimistic about market recovery, although probably we will only see a solid rebound in 2018. From a government perspective, it would help to have tax benefits for investment, because competition is high internationally. Countries in Africa offer very good conditions nowadays. From the consultants perspective, an alternative in the current market would be to sign contracts based on project performance. —



Paul Murphy

Manager South America
MINING PLUS

optimize the mine first to understand the optimal feed rate and head grade of the mine. Then, and only then, can the plant be designed. We have seen many times where the plant configuration is defined prior to the mine design, putting an unnecessary constraint on the operation.

How can shafts improve economics in deeper mines?

Shafts can save significant costs in deep mines. It all comes down to reduced operating costs to bring the material to surface. If it costs less to haul via a shaft than by trucks and you have a long life deep mine, then the math is pretty simple. Of course you have to consider the capital cost of the shaft, and all the standard financial measures that would normally be used for a large capital investment (NPV, IRR, pay-back period, etc). Even if a tradeoff study does not justify a shaft immediately, it will let companies know at what point haulage via a shaft becomes cheaper, and this is very important to know well in advance.

Could you give us examples of potential cost deferrals that miners are applying to save cash?

If you can keep money in your bank for longer, you increase the net present value of your project. In underground mining, companies can delay the construction of ventilation raises. In tailings management, paste fill offers great advantages, but cement and the paste fill plants are expensive, so you can introduce this method only once you can pay for it through cash flow. Another aspect to be considered is the rate of production. To start with a high production rate, you need high capital expenditures. A ramp up philosophy can reduce this upfront cost significantly and the expansion can then be paid for out of cash flow. On the other side of the coin, it is not all about cost deferrals and saving cash. I like to take a more proactive and positive approach with the attitude of producing more with less. It is amazing how many mine schedules are not optimized and are not targeting high-grade material early in the mine life to maximize the NPV and pay-back capital. It is not hard to do; it is just a matter of getting the priorities right when scheduling the mine. —

How important is to have a holistic approach to the operation from the study phase?

There are two phases in the study process that risk destroying value by not having a holistic approach. The first is in the early stages when companies are simply defining a resource without considering the bigger picture. Relatively speaking, drilling costs are significant, but collecting information from that drilling and the studies that follow cost fairly little. If you have gone to the trouble and expense of a drilling program, you would waste an opportunity by not taking all the information you possibly could from that core and finishing it off with some good, robust technical analysis. If you plan in advance, you can use the same core to log it geologically but also geotechnically.

The second stage is the processing plant and mine designs. It is very important to

Juan Rayo

Founder and Interim CEO
JRI



How is JRI doing in a context of low copper prices?

We currently have 270 workers, as opposed to 310 last year, so our downsizing has been very modest. We are a multi-disciplinary company that covers all aspects from the mine to the smelter. Originally we were very strong in studies for long-distance slurry transport projects. Today, however, one of our most important business lines is underground mining. We have been involved in two very large underground projects in Chile.

How important is Peru for JRI?

Between 8 and 20% of our work corresponds to Peru projects. We have many Peruvian clients, including Milpo, Minsur, Southern Copper, Antamina and El Brocal, among others. Emblematic projects for JRI in Peru include the concentrate pipelines for Antamina and Iscaycruz. In Peru we also own a construction company called Gerenpro that has done projects for medium-sized mines and for the general industry. We have built two new plants for Corporación Lindley, while we also took care of all the civil works for the expansion of the El Brocal mine.

Which areas of business offer more growth opportunities for JRI in Peru?

Peru's underground mines are changing: volumes are increasing and the infrastructure needs to become more complex and sophisticated. As Peruvian mines grow, they will require more engineering. On another note, we have great experience handling clay. Clay affects mining, grinding, flotation or leaching, thickening and tailings management. Over the years we have developed different strategies to deal with the clay, and this is an area of expertise that is virtually untouched in Peru.

Do you think dry stack tailings will become a widespread solution for the industry?

Dry stack tailings are still not a proven technology worldwide, as it is not being used for tens of thousands of metric tons per day. For those volumes, costs still appear to be too high. Escondida is testing the technology now for relatively high volumes, but I anticipate that over the next decades tailings will continue to be disposed in wet format. As JRI, we have a patent in five countries worldwide for an alternative development to dry stack tailings. We call it 'mining without waste'. The idea is not to build a tailings dam, but to return the tailings as a controlled paste and use it as a filler in the mine itself. It has the potential to become a technological breakthrough.

What other challenges do you see on the environmental front for mining companies?

South American countries need to be reasonable with their environmental regulations. In Peru, the norms for air pollution are so strict that they may cause smelters in the country to close down. Doe Run is still in trouble and noone has shown real interest to acquire its assets. The Ilo smelter by Southern Peru is also in a difficult situation. The norms should be progressive so that the industry can adapt little by little.

What are the main advantages of Peru and Chile for mining development?

Peru has more competitive costs in water, energy, and labor force. Energy costs in Chile have improved a little bit, but water costs are very high - about \$5 or \$6 per cubic meter. Labor costs are very high as well, and the workforce is much less productive than in Peru due to labor restrictions. However, Chile can offset these challenges with economies of scale. Chile offers a very good level of scientific, engineering and technical know-how: it is actually a great country for R&D. In the 1990s, Chile developed the technology of the Teniente Converter and sold seven units to smelters around the world. Around that time, Chile also developed the acid cure for oxides leaching, which dramatically increased metal recovery in leach pads. In terms of innovation, Chile still has an edge if compared to Peru.

What are your expectations for the copper price?

In Chile, with a copper price between \$2.50 and \$3, no producer will be losing money. However, there is a need to improve productivity. During the boom years, we completely ignored the focus on continuous improvement we had in the 1990s. It was more important to increase production as quickly as possible than to have a close look at process efficiency. I do not think that we will see a rebound in prices very soon, but I am not pessimistic either, because of the technological transformation that the world is undergoing. Hybrid cars, for instance, consume much more copper than a traditional car. Renewable energy generation units use much more copper than traditional thermal plants. Therefore, moving forward, the consumption of copper will be driven by developed countries rather than the emerging economies. We should see a new boom in metal prices in the next decade.

Image: STRACON GyM



The Environment

Samarco lessons

In November 2015, the burst of a tailings dam in Mariana, in the Brazilian state of Minas Gerais, left 19 people dead and caused enormous environmental and social damage. The tragedy, considered to be the worst environmental disaster in Brazil's history, reminded the industry of the dramatic consequences potentially caused by engineering, construction or maintenance failures.

Leaving aside the hefty compensations that Vale and BHP Billiton are expected to pay over the next years (expected to amount to several billion dollars), this accident triggered alarms about the sustainability of future projects, in a context where mines are becoming elephants that process huge volumes of ore every day.

A few days after the disaster, Golder Associates was hired by Samarco to provide assistance in environmental damage assessment and remediation strategies. The company has about 100 people working on this project, half of them in Brazil. "We developed a preliminary assessment of the impacts, which we used as a basis to prepare a detailed plan that is now under review by the Brazilian authorities. It is a very challenging project. From a resources point of view, putting together such a big team so quickly was not an easy task," explained María Eugenia Parot, vice-president Latin America at Golder Associates.

► 70



OUR SERVICE OFFERINGS

Pre-investment and Investment Phases
Commissioning and Operation
Specialized Consulting Services

EPC and EPCM Projects
Integrated Projects
R&D Projects

EXCELLENCE IN MINING ENGINEERING

OVER 33 YEARS OF EXPERIENCE

www.jri.cl

Perú: Calle Montero Rosas 103, Barranco, Lima
Chile: Luis Uribe 2343, Nuñoa, Santiago

María Eugenia Parot

Principal, VP Latin America
GOLDER ASSOCIATES



68

What was the rationale behind your recent restructuring for mining?

We have recently restructured our mining business as a single global organization to serve our clients more effectively across geographies and to deliver a consistent level of service. Nowadays, it is ever more important to provide consistent quality, regardless of where you are based, and to deploy global resources as needed. We also wanted to be more efficient in terms of resources, so we optimized our internal costs with a leaner structure and translated those cost-savings into better rates for our clients.

This new global mining organization consists of five divisions: Mine Waste; Construction; Environment; Mine Water; and MEG and Rock.

Could you give us examples of your construction services capability in the Lima office?

Golder has a dedicated team in Lima to provide construction services including QA/QC, commissioning, grouting, instrumentation, and monitoring. To a limited extent, we can also act as construction managers. Gold Fields at Cerro Corona and Antamina are two examples of clients for which we are currently providing construction services in Peru, specifically for their projects to expand tailings storage facilities. An example of our

acting as an EPCM provider has been Min-sur's Pucamarca project.

What are Golder Associates' key mining markets in Latin America?

We work with core teams in the markets that offer the best long-term prospects for us. Peru and Chile are our anchors in the region. We also have offices in Colombia, Brazil, Argentina, and now we are opening an office in Mexico. We are an employee-owned company and we move talent around quite a lot.

You are assisting Samarco in Brazil after their dam burst. Could you give us more details about this project?

Samarco retained Golder two weeks after the disaster to support them in the restoration of the environment affected by the dam breach. We developed a preliminary assessment of the impacts, which we used as a basis to prepare a detailed plan that is now under review by the Brazilian authorities. It is a very challenging project. From a resources point of view, putting together such a big team so quickly was not an easy task. We currently have about 100 people working on this project, of which 70 to 80 are based in Brazil.

How can Golder help in tailings management?

Golder is globally recognized as a leading company in integrated tailings management solutions. In response to the challenges of the mining industry, our solutions consider different technologies for tailings dewatering, transport, co-disposal, and backfilling into underground workings. Innovative technologies are more present than ever, due to the sheer size of the challenge the industry is facing. That is why, in designing the specific solution for a project, we consider the environmental and social impacts, which are key aspects in our designs.

How would you like to position Golder in Peru over the coming months?

We understand the main challenges faced by our clients in socio-environmental licenses, water and waste management, risk management, and, overarching all of this, the need to optimize costs. Today, our experts around the world, including those in Lima, are working together to provide cost-effective solutions to our clients to address all of these challenges through innovation, advanced technology and process optimization. We expect to be able to strengthen that position in Peru over the coming months and onwards. —



Alberto Coya

General Manager
MWH GLOBAL

69

Earlier this year, Stantec acquired MWH. What is the company's positioning in the market?

MWH Global is a worldwide engineering, consulting, and construction firm focused on water and natural resources, specializing in renewables and energy. We are very strong in wet infrastructure, so anything that has contact with water. We have been in Peru for 22 years, and in 2020 the company will be 200 years old. The company has grown through acquisitions; the most significant one was the acquisition of Harza by Montgomery Watson to form MWH in 2001. Harza added significant hydro-energy expertise to the company. In Peru we typically pursue projects involving environmental work, construction management, water resources, tailings and waste facilities, and hydropower and dams.

What have been the most recent changes in Peru?

In Peru, up until 2007, we were heavily involved in water and sewage projects for Sedapal. Then we shifted our focus towards mining and energy for private clients. Just recently, we have been very actively looking at the public sector again in many areas. We are also working hard at diversifying our client base to cover services such as

water treatment, water supply, hydropower, remediation, mine closure, etc. We are starting to offer in Peru services that MWH had been providing globally for many years. In mining, the boom for new projects has stopped. As part of our diversification process, we are targeting many new clients in the mining sector with smaller projects both in size and duration. During the boom years in mining, work flowed our way. Now it is us who need to go out and sell our services, and it is not a simple process for consultants. We need new business development skills that were not needed two years ago.

Could you partner with other engineering firms or technology providers to increase your chances of winning work?

It is always useful to know our competitors and the technical providers that we can team up with for specific solutions. As an engineering firm, however, we normally do not tie ourselves to one particular provider because we would be restricting the options for our clients. However, we do have various alliances with world-class technical providers.

How important is to do a fine job with tailings, considering their increasing volumes and the recent disaster in Brazil?

Big mining companies are using technical review boards to supervise their tailings facilities, to make sure that the existing infrastructure is safely built, enlarged and operated. With regard to new facilities, we need to generate very safe and cost-effective designs for our clients. Right now there are no new large projects ready for construction. We are involved, though, on some early studies for facilities that will be built a few years down the line. In these projects, we normally participate in all the different phases of the life of the project and in many cases provide continued support for many years.

What are your goals for the future?

We need to be very active commercially, provide excellent services and prepare the company for the next high cycle. We have reduced our head count from 2015 but have retained a good number of experienced engineers and experts that allow us to efficiently offer all the relevant services the industry needs. Right now we have a team of 190 people in Peru, and the mining industry will always be key for us. —



Dan Etheredge

General Manager
KLOHN CRIPPEN BERGER

69

What has been the evolution of the company over the last year?

Today, there is a smaller pool of projects, but there are more consulting companies around. With more competition and less projects, prices have come down. Some companies have gone really low with their pricing. At Klohn Crippen Berger, we are pretty small and agile, so we have been able to keep our staff busy with tailings work; especially after the Mount Polley and Samarco failures, we get lots of calls to do dam safety inspections and reviews. We do dozens of tailings studies on a global scale; it is one of our main areas of specialty. Tailings work, coupled with the repeat business with our core clients, has kept us busy. Here in Peru we are also finally working in the energy sector, in line with our other offices that have been working in energy for the last few decades. We have

done projects for Odebrecht Energía, Kallpa, Edegel and Engie (previously Enersur). In mining our main clients right now are Hochschild, Votorantim, Volcan and Antamina.

How do mining companies manage their footprint?

It is always easier to start fresh than take something that is already well advanced and try to modify it. However, we see this a lot, especially in today's tighter market, where mining companies start smaller to reduce *capex* costs, without taking into consideration the elevated modification costs required in the future. In addition, the communities are very sophisticated, and they know that there is money in the land surrounding mining projects. It is not uncommon that persons flock to the boundaries of mining projects and set up new residences. These aspects need to be taken into consideration at the start, because social issues can kill a project faster than anything else.

What went wrong at Samarco? Could dry stack tailings be the solution to avoid these disasters?

I am not sure if the Samarco failure mechanism is public yet, but I can say that it is perfectly feasible to design and build extremely safe tailings facilities. With regard to dry stack, you need to look at each project's economics to see if this solution makes sense or not. There is no one-size-fits-all solution. From a community standpoint, dry stack is usually the preferred alternative, because the perceived flood risk is eliminated, however the risks of slope failure, dust generation and run-off still need to be managed. We are actually working with one client on a pilot program to convert the tailings from all of their mines to dry stack; they do not want any more slurry tailings. With dry stack, you are dealing with a solid material, which you can transport in a truck or a conveyor, you can move it where you want and compact it. It is typically more expensive, because water removal and double-handling are required. With slurry tailings, the tailings are pumped to an impoundment, usually created with a dam, thus you have the risk of dam failure, as well as other issues associated with water management: acid generation, metal leaching, seepage, etc. —

Parot affirmed that innovative technologies for tailings management are more present than ever in today's mining sector: "In response to the challenges of the mining industry, our solutions consider different technologies for tailings dewatering, transport, co-disposal, and backfilling into underground workings," she said.

Antonio Samaniego of SRK developed on this issue: "Some companies are looking at dry stack tailings, for instance, that are easier to handle than traditional tailings. You can also have benefits from using the tailings as backfill. We are doing a project at Cerro Lindo looking at all these aspects, because Milpo has to pump the water from the sea, located 60 km away. Any savings of water are important for operational efficiency. We also completed a project for Fortuna Silver in Mexico, to immediately reuse the water of the tailings dam before it evaporates."

The main issue is, can dry stack tailings solutions be economically viable for large operations, and with low metal prices? "You need to look at each project's economics to see if this solution makes sense or not," said Dan Etheredge, general manager of Klohn Crippen Berger, a Canadian-based company with a strong focus on tailings work. "Dry

stack may not be the best or safest option in every case. From a community standpoint, it is usually the preferred alternative, because the perceived flood risk is eliminated, however the risks of slope failure, dust generation and run-off still need to be managed."

Juan Rayo of JRI affirmed that the wet component will not be gone soon: "Dry stack tailings is still not a proven technology worldwide, as it is not being used for tens of thousands of metric tons per day. For those volumes, costs still appear to be too high. Escondida is testing the technology now for relatively high volumes, but I anticipate that over the next decades tailings will continue to be disposed in wet format."

JRI has patented an alternative development that they call 'mining without waste', of which Rayo gave more details: "The idea is not to build a tailings dam, but to return the tailings as a controlled paste and use it as a filler in the mine itself. It has the potential to become a technological breakthrough," he said.

An example of how new ideas can mitigate the ever-increasing capital and operational costs related to environmental management is given by French multinational Veolia, that is working with Chilean state-company

“

When I entered the mining industry, risk was predominantly technical, and because of this, it was easy to measure. When you had a problem, you solved it, and that made risk go away. Today, probably 75% of the risk is non-technical. The only way to manage projects today is to focus on sustainability, with an ad hoc approach. Whatever worked in the north of Peru, may not work elsewhere. Whatever worked for a mining project may not work for projects in other industries.



- Rafael Dávila,
Latin America Mining
Sector Lead,
ERM

”

Codelco at El Teniente in a project where Veolia takes the soluble copper out of the tailings and provides the concentrate back to Codelco. Christopher Howell, Veolia's vice-president Mining & Metals, calls this a "waste-to-value proposition."

"Some mines have a positive water balance and need to discharge waste, typically converting it into solid waste that is easier to manage. If you cannot increase your footprint, you may want to remove the tailings from the storage facility to make space for new tailings. We are doing a pilot project in Brazil looking at a rapid, relatively mobile or modular dewatering technology. We are also looking at how Veolia can provide a process flowsheet as a service instead of a high capital cost item, providing a dollars-per-cubic-meter solution," explained Howell.

For the large size of the mines and the long lifespan of some of them, there will constantly be new projects to deal with the issues associated to the operations. Latin America has already become a key mining region and, as such, it already has world-class providers to help solve these problems. The focus should be clear on how to ensure the industry is sustainable on all fronts: environmental care, human safety and economic feasibility. Disasters like Samarco's cannot happen again. —

Construction

Offering support throughout the life of the mine

Big construction firms are following the same pattern of chasing smaller projects as a way of maintaining their strategic relationship with the mining sector. If for engineering consultancies this has meant competing with independent consultants, large contractors with top safety standards and integrated management systems have also started to compete with smaller family-owned construction firms.

Antonio Ferreccio del Río, general manager of HV Contratistas, believes that

the mining industry will win with the increased availability of large construction firms: "By hiring a formal, solid contractor, you get better productivity, you have no problems with the regulations and you do not need to provide finance to your contractor, so all these aspects need to be taken into consideration when calculating the overall project costs."

Yet large firms have had to adapt their cost structure as well, as high standards alone will not do the magic of winning new con-

► 73



**NEED INTEGRATED SOLUTIONS?
JUST ASK GOLDER.**

Since 1960, Golder has developed unique expertise providing consulting, design, and construction services in earth, environment, and related areas of energy. We have been delivering cost-effective solutions to clients locally and around the world that maximize value and minimize risks, while meeting your obligation to communities, regulators and the environment. Known as a leading brand in mining, our clients call on our specialist services in mine engineering and stability, mine water, mine environment, mine waste and construction services. Golder Mining is a provider of integrated engineering and environmental services from the earliest stages of mine development and throughout the life.

Peru +51 (1) 610-1700
comercial@golder.com.pe
www.golder.com/PE




**STRACON
Gym**

Committed to the provision of innovative and sustainable mining and construction services throughout Latin America.

www.stracongym.com

PERU
PANAMA
COLOMBIA
CHILE
MEXICO

Ricardo Vega & Pedro Romero

RV: President
PR: Territory Director
OHL



RV



PR

Could you summarize the main facts and figures about OHL worldwide and in Peru?

RV: OHL is a multinational group with five main divisions: construction, concessions, industry, developments and services. We are present in 30 countries and we trade on the Madrid stock exchange. Last year the company defined a strategic plan 2015-2020 whereby eight countries were identified as key growth drivers, or 'home markets', meaning we would have a permanent presence there. Peru is one of them, and we are currently present with our construction, concessions and industrial (EPC) divisions.

PR: We have a number of road projects, such as the Red Vial 4, currently under construction. Mining will continue to be a key element of our business, and also we are exploring other segments that offer great potential in Peru, such as ports, water and sanitation, and buildings both in the private and public sectors.

You entered the mining segment with very large projects. What is the situation today?

PR: In mining, we do not anticipate very big projects moving forward, so we are diversifying our offer to win medium-sized contracts. Another strategy we are pursuing is talking to EPCM companies in order to create synergies and bring efficiencies to the final client. Companies make large investments to build new mines, but then there are many smaller projects over the life of the operation. For instance, tailings dams need to add new capacity constantly, and gold mines need new leaching pads besides operation capacity expansions. We are already present in these types of jobs. We want to be present with \$5-10 million projects in order to consolidate our relationship with mining clients. Last year, counter-cyclically, we invested \$20 million in new machines. When you are the owner of the equipment you can offer better rates to the market.

RV: In OHL Industrial, for EPC projects, we also have equipment for mineral handling. We had a nice project in Peru whereby we developed the EPC and then we were running the plant under an operation and maintenance model. Unfortunately, shortly after, the client changed its strategy and the project was interrupted. We are talking to different mining companies and there is an increasing interest to outsource the first stages of the mineral processing. The advantage for mining com-

panies is that they get a fixed price per metric ton. As a contractor, we would make all possible efforts to achieve the best production rate. In Chile we already have two large projects under this model, with Codelco and BHP Billiton.

How do you approach safety and environmental matters?

PR: In Las Bambas we completed 15 million man-hours without any lost-time incident (LTI). In Antamina we had a smaller project but we had 1,000 people at some point and we had 1 million hours without any LTI. For us, adapting to the safety requirements of the mining industry was a great process and we have taken these high standards to other infrastructure segments. Human life is the most important thing we have and as OHL we have a team permanently auditing all our projects and providing training. So far, the results speak for themselves. It is important to mention that we are certified by a global provider of technical, safety, and certification services (TÜV Rheinland) in ISO 9001, ISO 14001 and OHSAS 18000.

You work a lot on tailings dams. How can disasters like the Samarco accident in Brazil be prevented?

PR: Sometimes we do EPC projects where we are in charge of the engineering, and sometimes we just do the construction as per the client's design. As part of our policies, we always revise third-party designs prior to starting the construction. This comes at an extra cost to us but this way we give greater assurance to the client about the final result. It is an added value we provide. Additionally, a strict quality control is applied during the construction process to ensure design specifications in field works.

How do you think the market perceives OHL in Peru today?

RV: Since 1999, we are well known in the road construction segment. Then, we have been present in the mining sector since 2011, and today we are a relevant player in Peru and Chile's mining industries. We had a strong delegation from various OHL offices at the PDAC. We were not a mining player before, but we are today. At a general level, there are only eight 'home markets' for OHL (from our presence in over 30 countries worldwide) and Peru is one of them: this sends a strong message to clients. —

◀ 71

tracts. OHL, for instance, decided to invest \$20 million in new equipment last year, counter-cyclically, as a way to offer better rates to the market.

With this renewed fleet, the idea of the company, which previously undertook very large projects at Antamina and Las Bambas, is to win smaller *opex*-related projects. "Tailings dams need to add new capacity constantly, and gold mines need new leaching pads on top of their operation capacity expansions. We are already present in these types of jobs," said Pedro Romero, territory director at OHL.

Diversification not only applies to the size of the projects. At OHL's industrial division, for instance, one of the goals is to start working in operation and maintenance contracts for mineral processing plants, as they already do in Chile for Codelco and BHP Billiton. "The advantage for mining companies is that they get a fixed price per metric ton. As a contractor, we would make all possible efforts to achieve the best production rate," explained Ricardo Vega, president of OHL in Peru.

STRACON GyM, one of Peru's largest mining contractors, is also looking at new business models in order to win more work, while it increasingly looks at markets outside of Peru to offset the decrease of new large capital investments in the country. A project that exemplifies both strategies is the San Ramón gold mine in Colombia, where the company has actually taken a stake in the project in order to help the client with the financing and obtain contract work in return. "We are not interested in becoming a mining company, but we will look to support projects where we can supply services and add value," affirmed Steve Dixon, CEO of STRACON GyM. The company also keeps its eyes open for underground mining opportunities within the region. —

Global expertise serving the Peruvian mining industry



One of the main international Construction and Concessions groups, present in Perú since 1999, provides its experience and global support for the development of mining and infrastructure projects.

Obrascón Huarte Lain, S.A - Sucursal del Perú
Av. 28 de Julio 150, of 701 - Miraflores - Lima 18
Telf: (+511) 625 7200 www.ohl.es



Sistema de
Gestión
ISO 9001:2008
ISO 14001:2004
OHSAS 18001:2007
www.ohl.com
ID: 916017619



OHL

Steve Dixon

CEO
STRACON GYM



“

There is going to be another period of growth in Peru with a lot of infrastructure work, and in terms of mining, once commodity prices show signs of recovery we will see fresh new investment.

”

Have you been affected by the reduction of new capital investment projects?

Last year we closed with a turnover of \$430 million, which was a bit lower than in 2014, and this year we are forecasting \$350 million of revenue, so roughly 20% down on last year. It is a very tight market at the moment. Most of our business this year will come from existing contracts that we have had in place for some time, with a small amount of new work. Over the last couple of years, we have been working on the construction and startup of Constancia and Shahuindo, but right now, when we look around, there are not many new projects like these. The breakdown between mining operations activities and construction work is 50/50 at the moment, but moving forward into 2017, we anticipate mining to account for 65% of the total, reflecting the lack of investment in new projects.

How could you offset this slowdown in Peru through internationalization?

We are speaking with several clients with projects in the region, and we also want to exploit the synergies within the Graña y Montero group to find opportunities outside the country. Graña y Montero recently constructed a project in Guyana; as STRACON GyM we are working in Panama; and we have subsidiary companies established in Chile and Colombia. We are also looking at innovative strategies: in Colombia, for example, we took a small investment in an underground gold project, Red Eagle's San Ramón, to help the project get off the ground and secure the provision of services during the construction, development and operation phases. We are not looking at very small projects, and we are not looking for mega projects either. We are not interested in becoming a mining company, but we will look to support projects where we can supply services and add value.

Would you like to increase your participation in underground mining?

We already have underground expertise; the San Ramón project in Colombia is underground, for instance, and we have also done underground work in Peru. We are looking for similar opportunities throughout the region, in Mexico, Argentina and Chile. In Peru, underground mining is a very old industry and a very competitive

market where the culture has not yet internationalized in terms of its development and the contractors base. The projects out there right now are very small, but some companies are starting to think differently and we want to position ourselves in this segment for the future.

You employ 5,000 people across several countries. What are the challenges in terms of recruitment and safety?

We invest heavily in training programs for our general workforce and for the communities around our projects. We have invested in two simulators to support our training initiatives. At Constancia, for instance, we trained personnel from local communities to work as operators of the large Cat 793F trucks. In terms of safety, training is also key. We continue to strengthen our safety culture and ensure that all our people are responsible for their own safety and the safety of those around them. We insist that, if something is not clear, or they do not understand something, they need to stop the activity and take the time to ask. There is always pressure on productivity, on time, on performance, but it is essential to get that culture in place. Managing fatigue is also very important when you talk of truck drivers or other equipment operators. We have a system in place that has improved our indicators in this respect. Our biggest risk, overall, is transporting people in and out of the projects. Peru has a shocking amount of fatalities on the roads. We have invested heavily in this area, including a project we call ‘Condor’ that observes in real time bus and light vehicle driver behaviors, utilizing cameras and GPS technology.

What are the prospects for STRACON GyM?

Following the elections, the political environment looks more comfortable for the coming years. There is going to be another period of growth in Peru with a lot of infrastructure work, and in terms of mining, once commodity prices show signs of recovery we will see fresh new investment. It is just a question of time, but I do not think it is going to happen quickly. This is why our company is also actively looking for opportunities throughout Latin America. We currently have a healthy backlog but we need to secure new business for 2017 and beyond. —

Antonio Ferreccio del Río

General Manager
HV CONTRATISTAS



“

Smaller companies are starting to suffer with lower margins and are having difficulties to pay their providers. The main problem in the industry today is cash flow, and not just in mining: in all segments the clients are being very cautious about new investments.

”

What are the latest developments for HV Contratistas in the mining sector?

New projects are taking longer than expected to be developed because of two factors: the internal situation with the election, and the global metals pricing scenario. Metal prices are not so low if compared to other previous low cycles, but the problem is that costs had increased exponentially over the boom years, and that is where the industry needs to find a new balance. Companies have been cutting some costs but other expenses are more difficult to eliminate, due to the regulatory requirements in environmental, labor and other aspects. Hopefully the new president gets involved with the mining industry and helps overcome the social problems.

Within mining, what are your main areas of expertise?

We do civil works and mechanical and electromechanical installation. Creating synergies with our mother company, SalfaCorp, we could do earthmoving projects, tunneling and underground mining works, areas where we are currently not involved in Peru. In Chile the group has a company specifically dedicated to tunneling and underground mining activities, called Geovita. This provides us with an excellent platform to expand to the underground segment.

Do you think this low period will result in some consolidation in the construction segment?

We still do not see any consolidation because the backlog of projects has been good over the last years, so companies are still living off that. However, you can already see that smaller companies are starting to suffer with lower margins and are having difficulties to pay their providers. The main problem in the industry today is cash flow, and not just in mining: in all segments the clients are being very cautious about new investments, launching small projects little by little. I believe this will still be the trend for the remainder of the year. Luckily for us, we still have a good backlog, mainly in the buildings segment.

The construction industry is always cyclical, it has always been like this in my 22 years of experience in the business. When there is a crisis, some levels of stress are good to actually take out the fat that the organization has accumulated over the good years.

As clients push for lower prices, what is the challenge to maintain the highest standards?

Industry standards suffer when the clients push for lower prices. Certainly, some smaller providers can offer better rates, however high standards cannot be seen as a cost, but as an investment. By hiring a formal, solid contractor, you get better productivity, you have no problems with the regulations, you do not need to provide finance to your contractor, so all these aspects need to be taken into consideration when calculating the overall project costs. As part of our management system, we have the triple certification. The main pillars are taking care of human life, delivering the projects with quality and in a timely manner, respecting the environment and being profitable. With these standards we can ensure all our projects are managed in the right way. Safety is the most important thing. It is not just about the loss of human life; accidents have a negative psychological effect over the rest of the workers, and as a result productivity decreases. Also, there are medical expenses, the project can be stopped by the authorities, and so on so forth. It is always more efficient to do things right from the beginning.

Where would you like to see HV Contratistas by the end of 2016?

In mining, we are following very closely all the civil works and installation opportunities that may come up. We want to keep our relationship with the mining sector. Besides that, we have high expectations about the power segment. There is an excess of energy supply right now that has slowed down investments, but companies that have a power purchase agreement (PPA) have strict deadlines to deliver the energy, so we should see new opportunities there soon, especially if we finally start exporting electricity to Chile. Our philosophy is to focus on our clients and deliver good results: that is, to finish the projects with the quality results they expect, and according to the plan. We are focused on being not necessarily the biggest company, but the best one. We are general contractors, so we are up to dealing with any challenge that the client may have. —

Construction Ancillary Services

A well established pool of providers, local and international

General contractors are not the only companies affected by the decrease of new capital projects. The electromechanical industry, for instance, is also reshaping themselves. Esmetal, a manufacturer of metallic structures with operations in Peru and Chile, only sees 30% of its metallic structures business going to the mining sector this year. As part of a strategic diversification plan, the company invested \$2 million in a new plant to provide painting services

for new metallic structures or industrial maintenance for third parties. While the metallic structures business has not decreased, the new coatings business already represents 25% of the total revenue. The company has also integrated vertically to do basic engineering and also to provide installation services. "Up until last year, 95% of our business was just the fabrication of structures. With the new business units (engineering, installation,

painting services) we are a completely different company," explained Diego Aguirre, general manager of Esmetal. Jorge Reátegui, general manager of Layher, a German supplier of scaffolding and temporary structures, said that most of his business is going to come from industrial maintenance activities, with the exception of the Talara refinery, the expansion of Southern Copper's Toquepala mine, the new Metro line in Lima and a few malls

► 80



INSTITUTO DE INGENIEROS DE MINAS DEL PERÚ

Organiza:



GESTIÓN MINERA

III Congreso Internacional



BUILDING THE FUTURE OF MINING IN PERU

FROM NOVEMBER 14 TO 16, 2016

MAIN TOPICS

- 1 Strategic management of the mining industry
- 2 Financial Management
- 3 Human capital management
- 4 Productivity management
- 5 Environmental and social management
- 6 Management of information technology, communications and automation

FOLLOW US:
f | | in |

www.gestionminera.com.pe
gestionminera@imp.org.pe
Phone: (511) 313.4160
Ext.: 256, 257, 233

Mario Balbín

Technical Commercial Manager
MACCAFERRI



What is the history of Maccaferri worldwide and in Latin America?

Maccaferri has been operating since 1879. In 1893, Raffaele Maccaferri invented the gabion, which is a steel basket with a wide variety of applications. Maccaferri arrived in Latin America in 1974, and we have had a factory in Peru for 16 years, producing gabions, Terramesh systems and nets. We also produce metallic fibers for the underground mining and construction segments. Here in Peru, we are focused on engineering solutions for the mining and infrastructure segments. The gabion continues to be a key product. It is a very simple solution that can be used in highly demanding applications.

Could you describe some emblematic projects for Maccaferri in Peru's mining industry?

We had a big project at Las Bambas for the construction of the city of Nueva Fuerabamba. We were hired to provide slope stabilization

services and this required drilling and the installation of bolts, nets and dynamic barriers. We worked there for nearly two years, for Graña y Montero and also directly for Xstrata. At Antamina, we installed nets for rock fall protection inside the operation. It was quite a complex project because we had to work inside the mine, at a height of 180 meters, in order to prevent rock falling to the pit. Another big project for us was the supply of a reinforced soil system for Hudbay Minerals at Constancia. We provided a 30-meter tall wall to protect and stabilize the primary crusher. We did the engineering, and construction was executed by San Martín Contratistas. We have also installed these sorts of systems in Lagunas Norte for Barrick, and in Gold Fields La Cima we installed another system using the Terramesh technology.

What is the importance of innovation in this business?

Peru offers challenging conditions where we have been able to offer innovative solutions. A few years ago, we had a project for the Cobriza mine, where the client had a very challenging topography and they needed to maximize the capacity of their tailings dam. We installed some drainage geo-synthetics and a filtering system. By reducing the wet component of the dam from 40% to 12%, we managed to increase the total capacity by 20%. From an environmental perspective, we have systems to mitigate the impact of erosion and to control sediments, which are issues that are currently affecting Samarco. We are developing special linings that are much more resistant and can work in much more aggressive environments. We are also working on a new generation of gabions.

Amell Tejada

Commercial Manager
FREYSSINET
TIERRA ARMADA



What is the presence of VINCI's civil engineering business in Peru?

Soletanche Bachy and Freyssinet Tierra Armada are the two specialized engineering companies part of VINCI of France, one of the top five contractors worldwide. Freyssinet and Tierra Armada are originally two different companies. Freyssinet invented the prestressed concrete beams. Tierra Armada (Terre Armée) is the company that invented reinforced earth walls, where we have managed to get 70% of the market in just a couple of years. With Soletanche Bachy, we do all sorts of underground work for mining and infrastructure sectors, including foundations, tunneling and shotcrete.

Could you tell us about your mining projects with Tierra Armada?

In Cerro Verde we built the world's tallest reinforced earth wall to support two primary crushers. The wall is 33 meters high and it has

4,500 square meters of facing. It was built together with Graña y Montero. In Cuajone we offered a very specialized solution as well using our Terralink solution, consisting of reinforced earth walls that are linked to the slope. We have also provided Terralink solutions at Las Bambas, where we added a different aspect with the introduction of synthetic reinforcements. We see a lot of potential to continue working in the mining sector. Even if there are less capital projects, operating mines have a constant need for new solutions. We are currently implementing a large project at Antamina, where they are enlarging their tailings dam in two phases. The first phase is a 30-meter expansion of the dam, but the resulting increase of the slope would affect a small lagoon that belongs to the community, so we have developed an innovative solution to make sure that the water flows are not affected. We are using our TechSpan precast concrete arch system; indeed, the vaults used at this project are going to be the largest ones ever used by the corporation worldwide.

How does seismic risk affect your designs in Peru?

In Brazil, designs barely incorporate any seismic risk, but the risk factors here are very different, and so are the regulations. As a corporation, Terre Armée, together with AASHTO, has carried out studies in Japan about the impact of the Tohoku earthquake in 2011 on reinforced earth walls. They concluded that reinforced earth walls had a much better performance in front of an earthquake than traditional solutions such as reinforced concrete walls or anchored walls.



Jorge Reategui

General Manager
LAYHER

How has Layher's business grown in Latin America?

Layher is a German family company, with more than 70 years of history, dedicated to the provision of scaffolding and temporary structures. We have offices in 45 countries and we have distribution points in over 130 countries. We are very strong in Europe, and we are growing in North America, Asia and Latin America. Chile and Peru are the most important countries in terms of our participation in the mining sector. We have been in Peru for nine years and we have three warehouses; in Lima, Arequipa and Piura. We also offer on-site services to help clients optimize the use of the equipment. At a corporate level, we are a very innovative organization, so we are constantly launching new products and new materials to match the needs of the market.

What is the size of your operation in Peru?

Over the last nine years, we have imported around 12,000 metric tons (mt) of equipment, and right now we have about 10,000 mt of stock. Our largest project was Cerro Verde, where we had nearly 5,000 mt of equipment in the project at peak, working with the different contractors. Between 2013 and 2015, we grew by 20-30% annu-

ally. Now, the market for new projects has cooled down, but we continue to import new equipment because mining operations constantly need maintenance. This brings new business opportunities for us and for the contractors. The mill maintenance, for example, is a very specialized job, and companies in the electro-mechanical segment are increasingly providing this service, which requires a rapid response and an intensive use of scaffolding. This is helping the professionalization process of scaffolding installation.

Layher has trained thousands of people over the last years in Peru. How valuable is this for clients?

As part of their corporate social responsibility programs, mining companies often ask their providers to hire people from their areas of influence. Unfortunately, not all these people have enough skills, so we can provide training in scaffolding installation, as we have done with Cerro Verde and Petroperú. People who go through our 3-4 day training program learn the trade of operating scaffolding and become employable for other companies. As an example, operators from Cerro Verde went on to work at Las Bambas as well. Also, training is important to build our brand reputation: we need to make sure that our scaffolding systems are properly installed and handled.

How can you help mining companies in terms of project efficiency?

Our competitors in Peru have good products, but they are also suppliers of formwork, so they are not as specialized in scaffolding as Layher. When we make a proposal, we talk in cubic meters per metric ton. We can provide 45,000 cubic meters of scaffolding with 100 metric tons, while other providers require 120 metric tons. Having a lighter system brings efficiencies in terms of the freight and the logistics costs. In order to achieve that, we work very closely with the clients: last year we started a new training program in good storage practices. This helps mitigate the possible damage to the equipment. Also, we teach clients to pack their cargo efficiently. Sometimes we dispatch an order in 20 trips, and then the client uses 30 trips to return the equipment. You can save a lot of money by loading the trucks efficiently. —



Diego Aguirre

General Manager
ESMETAL

Where do you stand in the metal-mechanics sector?

We are the largest service provider in Latin America and the Pacific coast related to metallic structures, including the design, fabrication and installation. We have historically been very reliant on the mining sector, but we are now increasingly serving other markets. We have operations in Peru and Chile. In Peru we have two plants, the main one in Callao and another one in Lurín. Over the last three years, we have expanded our capacity by 40%. In Chile our plant is in Talcahuano, Concepción, also dedicated to metallic structures. What we have done is to integrate vertically to include a stronger engineering department: we are now designing buildings and structures for clients. We have also extended our reach towards the last part of the value chain, which is the installation. Besides this, in Peru we have invested \$2 million in a large coatings plant in Lurín, which is probably the country's largest, with 43,000 square meters, of which 10,000 square meters of indoor painting capacity. We can paint 2,000 metric tons per month of metallic structures or other products such as pipes. It is a business that has been growing significantly over the last 18

months, and we have already covered 80% of our capacity, even if the mining sector is not very active for new projects.

What levels of business do you currently have?

On the metallic structures side, we have a fabrication capacity of 1,500 metric tons per month, depending on the product. 2014 was our record year and we produced 1,200 mt/month. This year we are at levels of 1,100 mt/month, so it is a good period for the company. Mining represents 30% of our business; the rest goes to oil and gas, energy, the Talara refinery and the infrastructure segment. In mining, we are finishing a small contract with Southern Peru; we expect to get some work for the expansion of Toromocho, and we are also participating in bids for the expansion of Toquepala. In infrastructure we are very active in metallic bridges, and we are increasing our participation in medium-sized projects for malls, industrial projects or warehouses. For the Talara refinery we have a contract for 14,000 metric tons of structures, and we hope to win additional work for next year there.

What weight are your new services gaining?

We are looking at providing maintenance services based on our coating capabilities, and from there we could explore other opportunities, in mining and other sectors. Up until last year, 95% of our business was just the fabrication of structures. With the new business units (engineering, installation, painting services) we are a completely different company. In 2016, with the contracts we already have, 25% of our revenue will come from painting services, and they should reach 30% of the total soon.

How do you expect your business to evolve, and do you think mining will be your key client anytime soon?

Even if the next two years will not be heavy on the mining side, Peru is a mining country and mining will always be a key sector for us. We want to continue growing in other segments, while we will be ready to work again with the mining industry when new projects are triggered. That is the advantage Peru offers: there are mining developments, but also interesting growth in several other segments. —



Cristopher Varas

General Manager
GRUPO VIVARGO

What has been the evolution of Grupo Vivargo over the last years?

Since 2010, Peru has seen aggressive levels of growth in terms of new investments. Back in 2010, we had equipment dedicated to installation activities, such as platform trucks, crane trucks and heavy-duty cranes. We saw opportunities to continue investing and renew our fleet. To work in large investment projects, we bought the latest generation of equipment. We have more machines and with bigger payload capacities.

We have three business lines: equipment rental, JLG equipment sale, and warehouse management. Equipment rental is our most important business and, today, we have a diversified fleet to provide an integrated solution. We continue to provide services in the mining segment, finishing the large capital projects from last year and also starting some smaller projects. In energy, we are participating in the wind farms that are being built, which is a new area of development for the country. We have also been active in the construction of the main thermal-gas plants, and we are also working on different maintenance projects across the industry.

Peru still has a big infrastructure deficit and we plan to be present in all the projects that are going to come through over the next years. Moving forward, a key project will be the Talara refinery, and we will see some smaller expansion projects in the mining segment.

Could you name some of your main clients?

We have been present in the main mining projects over the last years. For Antapacay we provided the full crane rental service. In Las Bambas we also had our largest cranes with an excellent track record of zero accidents. It was a great result for the mining company and for Bechtel, the company that hired us. We also participated in Chinalco and in the expansion of Cerro Verde, where we were the main heavy-lift contractor. There, we rented equipment to Cerro Verde, to the EPCM company and to the different construction groups such as Cosapi, Graña y Montero and Skanska. We are also doing some work for Antamina.

How are you expanding beyond Peru's borders?

We are now present in the Chilean market. Chile is a more mature market and companies there are starting to sign long-term contracts with their providers. This helps obtain more competitive rates, while the provider can plan in advance in terms of equipment purchases and human resource development. Mining companies do not want to have their own fleets, because that is not their core. In Peru, we still do not see a trend towards long-term contracts, but we will have to copy the models of other countries soon.

How do you see your business evolving in 2016?

We have conservative plans for this year. Since 2010, we have been growing by 30% every year. This year, our projection is to keep the same levels of 2015. If we grow, it will be at modest levels. Then, for the medium-term we expect to win projects in Chile and Ecuador, where we have offices; also in Bolivia. In Peru, we will chase the contracts that offer longer terms and where we can bring more value. Our strategy is not to compete on price: the lifting business is a risky business, so we cannot compromise our quality. —

◀ 76

here and there. While Layher would like to sell more scaffolding equipment to the market, Reátegui pointed out that rental will continue to be a key driver in the country: "Companies in Peru are yet to develop a culture of taking care of their equipment and, especially, following the regular maintenance schedules. In Peru we have around 10 companies buying equipment from us every year; in a more mature market, you could easily have 100."

Vivargo, a company specialized in the provision of lifting and installation equipment, such as platform trucks, crane trucks and heavy-duty cranes, also sees most of its revenue come from rental. The company grew by 30% annually since 2010, thanks to the record levels of investment in the mining industry, and has also entered new segments such as energy, with the installation of wind farms and thermal gas plants. Moving forward, growth projections are more conservative. Christopher Varas, general manager of Grupo Vivargo, anticipates that industry diversification and internationalization will be a good recipe for Peruvian mining contractors and providers: "We expect to win projects in Chile, Ecuador and Bolivia. In Peru, we will chase the contracts that offer longer terms and where we can bring more value. Our strategy is not to compete in price," he said.

Engineered solutions

The large infrastructure required to put large mining projects into operation is also



Image: Shahuindo, courtesy of STRACON GyM

a great engineering challenge for the providers of specialty structures and materials, such as TDM, Maccaferri and Tierra Armada. The latter, part of the Vinci group of France, won its first project in Peru to design a reinforced earth wall solution for Southern Copper at Toquepala, for a total structure of 40 meters: a 28-meter wall plus a 12-meter slope. Amell Tejada, commercial manager of Tierra Armada, explained that this project acted as a great reference to win further work in Peru afterwards: "In Cerro Verde we built the world's tallest reinforced earth wall to support two primary crushers. The wall is 33 meters high and it has 4,500 square meters of facing. In Cujone we offered a very specialized solution consisting of reinforced earth walls that are linked to the slope. We have also provided

Terralink solutions at Las Bambas, where we added a different aspect with the introduction of synthetic reinforcements," Tejada said.

With regard to Maccaferri of Italy, the company that invented the gabion in the 19th century, the company has had a factory in Peru for 16 years, producing gabions, nets and metallic fibers, among others. Mario Balbín, Maccaferri's commercial manager, elaborated on how the company has managed to keep its relationships with mining clients by focusing on operational projects: "We have continued to carry out work for mining clients inside their areas of operation. In Antamina we installed nets for rock protection, and we are going to start a similar project with Cerro Verde. We are also up-to-date with the latest developments in underground development, thanks to our provision of metallic fibers for shotcrete preparation." —

TUMI
RAISE BORING

MORE THAN 40 YEARS OF DRILLING EXPERIENCE

YOUR COMPLETE RAISE BORING SOLUTION!

Tel: +51 (1) 717 8034 RPC: 968 289 294
Email: sales.ventas@tumiraiseboring.com

Underground Contractors

Dynamism below the surface

In a context where new open-pit projects are scarce, it makes sense to have a look underground. Peru is indeed home to a large number of underground operations that, if not as large as the big surface mines, still have constant needs for development work.

STRACON GyM, traditionally an earthmoving and open-pit mining contractor, increasingly wants to look at underground activities, like the San Ramón mine by Red Eagle, where it has actually made an investment in exchange for contract work. "We are looking for underground mining opportunities throughout the region. In Peru, this is a very competitive market. It is an old industry and the culture has not yet internationalized in terms of its development and the contractors base. The projects out there right now are very small, but some companies are starting to think differently," affirmed Steve Dixon, CEO of STRACON GyM.

Meanwhile, HV Contratistas, specialized in civil works and mechanical and electro-mechanical installations, is also evaluating entering the underground mining market, capitalizing on the expertise of their mother company in Chile, SalfaCorp. "In Chile, the group has a company specifically dedicated to tunneling and underground mining activities called Geovita. This provides us with an excellent platform to expand to the underground segment," said Antonio Ferreccio del Río, general manager of HV Contratistas. One of the key areas in underground mining is rock support, and the mechanized application of shotcrete is increasingly widespread in Peru's mining sector. Enrique Sattler, general manager of Robocon, a specialized shotcrete contractor, explained that innovation has played an important role in increasing productivity in areas like compressed air supply and computerized systems to incorporate the different shotcrete additives.

As underground mines extract ore from deeper locations, there is a need for new solutions to take the shotcrete down from the surface to the mine face: "In the main underground operations worldwide, operators have implemented solutions to transport the shotcrete via vertical pipes or 'slick lines' that reduce mining cycle times and the amount of people and vehicles required, as well as traffic and pollution within the mine," said Sattler. These pipes, with lengths between 200 and 1,000 meters, can save between two and six hours to transport the shotcrete, improving productivity in remote faces.

Another example of innovation in underground operations is provided by TUMI, a specialized raise boring contractor that designs and manufactures its own machines at a new 38,000 square meter facility in the outskirts of Lima. After an abrupt slowdown during 2015, business has recovered this year and the Peruvian fleet of 13

machines is fully booked. The company is opening up an operation in Chile as well, where it is bidding for projects at El Teniente. Marc Blattner, general manager of TUMI, affirmed that the company's machines have changed the way the market sees raise boring. If before it was seen as a cost, now it can be applied to productive processes with the SBM 400 SR for slot raises. Today, the SBM 400 SR is working with clients like Milpo, Minsur, Pan American Silver and Fortuna Silver. TUMI is now working on a larger machine, the SBM 700 SR for the needs of larger underground operations: "The SBM 700 SR can dig holes of 3.1 to 4 meters of diameter. Here in Peru the market does not require such sizes, but the Chilean market does. The needs at El Teniente match perfectly the capabilities of the SBM 700 SR," concluded Blattner. —

PERU'S INTEGRATED SHOTCRETE SOLUTIONS PROVIDER

info@robocon.pe robocon.pe

Enrique Sattler

General Manager
ROBOCON



What changes have you implemented to adapt to the low cycle?

During the crises created by the low mineral prices, mining companies are forced to drastically reduce costs, and mining contractors are affected by this in several ways. For us, it is important to innovate across all company areas to keep the quality of our service, be flexible to open and shut down operations, find alternative financing sources to buy equipment and offset the longer payment periods by the clients. All this, while maintaining high operational levels of the equipment and high occupational health and safety standards. Crisis times offer great opportunities to optimize resources and processes, so we need to prepare for the next cycle of high prices.

Could you elaborate on your range of services?

We are leaders in the segment of ground support via shotcrete in mining operations, taking care of all steps of the process, from concrete production in dosing plants to its transportation and application with specialized equipment. We also supply the necessary materials and do the necessary quality control. We have strategic alliances with several companies. We are subcontractors for tunneling activities, managers of infrastructure work within the mines, and providers of specialized equipment, technological solutions, additives, aggregates, cement and concrete for backfill. Moreover, we are now starting to work in narrow-vein mines, offering equipment and solutions for tunnels as small as 2 x 2 meters.

What new technologies are you incorporating in this business?

At an equipment level, machines now include autonomous compressed air supply systems, the ability to work with diesel or electric engines, computerized control over additives doses, and better safety features. We have also started to use simulators to train our operators.

Another important innovation comes out of the necessity to improve shotcrete transportation solutions from the surface, as mines are increasingly deep. In the main underground mines worldwide, operators have implemented solutions to transport the shotcrete via vertical pipes or 'slick lines' that reduce mining cycle times and the amount of people and vehicles required, as well as traffic and pollution within the mine. These pipes, with

lengths between 200 and 1,000 meters, can save between two and six hours to transport the shotcrete, improving productivity in remote faces. We are currently presenting slick line solutions to three mines in Peru, working in partnership with chimney drilling contractors, concrete technology and additives suppliers and engineering players, in order to provide the required support locally.

What extra value do you offer with the cement plants, the additives and the transportation systems?

Integrating all services is a must in order to provide the best ground support solution at the lowest cost possible. In this respect, you need the right machine for each job, you need to choose the best suppliers, minimize downtime and waste, integrate processes with the client and have a good coordination with the different mining managers. We have the necessary infrastructure to serve the needs of underground mines in Peru, and our investments have been targetting our capacity in services and repair for mobile equipment. We have also invested in new concrete plants to consolidate our process of vertical integration in all the mines where we operate.

Who are your main clients in base metals and gold operations?

Our main clients are polymetallic underground mines in the Central Andean range, Volcan and Pan American Silver. We also participate in ground support work for exploration tunnels in the Yanacocha gold mine in Cajamarca, in partnership with AESA, another contractor. We are currently present in seven underground mines, and we expect Yanacocha to become an underground mine in the future, which will open many opportunities for all the suppliers of equipment and services in this segment.

What are the prospects for 2016-17?

We want to consolidate our level of service towards our clients; to abandon the crisis model and implement a business model that allows for more growth; to attract new clients while incorporating new technologies and processes; to implement the guidelines and methodology of the European Federation of National Associations Representing for Concrete (EFNARC), of which we are members; and to give more impulse to our renting service, with a fleet exclusively dedicated to infrastructure projects such as the metro lines or hydropower projects. —

Marc Blattner

General Manager
TUMI RAISE BORING



How does your new facility in Lurín set the foundations for the future of TUMI?

TUMI has gone from a 1,000 square meter shop in Callao to a 38,000 square meter facility in Lurín. As a company, we have increased profits by 15% and decreased costs by 35%. We are in the process of completing the tri-norm certification and the aim is to have a sustainable business with this new facility, where we will have the capabilities to keep working in the raise boring industry, but also to provide heavy equipment maintenance services.

Your focus is on the contracting business or on the sale of new machines?

The mentality of contracting versus the mentality of sales is completely different. There was a humongous slump in contracting work from August till December 2015. We had to downsize to adapt to the market situation, but now all our fleet is busy again, with 13 machines running 24/7, and with enough backlog until the end of this year and part of 2017.

In the sales part, we have just hired a new bilingual manager from the U.S. and he will be heading our new strategy for sales internationally. In Peru we try not to sell machines, because that hurts our contracting business. Argentina is shaping up as a great market for us after the political changes and we will be pressing the market there. We are also starting a new company in Chile, where the contracting market is quite big and we are part-

nering up with a new company called SCM. We have bids out with different contractors for two major projects at El Teniente. Within two to three years I hope to have 10 to 13 machines in Chile as well.

Raise boring is a very niche activity. What is the challenge of training the required operators?

Training is the most important part of any job. Before, companies would start training at the mine; now, you go through quite a lot of training before you even reach the mine. Finding new employees is always a difficult thing. If I go to the market, I can find 1,000 scoop operators and 10,000 jumbo operators, but I may just find one raise boring operator. Pretty much all the people need to be trained in-house from scratch. In Chile, however, there are operators available so there is an opportunity to head-hunt there.

What was the impact of the SBM 400 SR (Slot Raises) model?

Hochschild is where the idea came from; we sat down and they asked if we could make a machine that was mobile, self-leveling, self-erecting, self-pinning and that in no way needed cement for the drilling operation or set-up. We made it happen. We have been very successful in Cerro Lindo with the SBM-400 SR, and this model is also working at Raura, Bateas (Fortuna Silver), Argentum (Pan American Silver) and San Rafael (Minsur).

We are now finishing the design of the SBM 700 SR, which offers bigger capacity. The 400 SR was designed to do holes between 1.8 and 2.4 meters of diameter. The SBM 700 SR can dig holes of 3.1 to 4 meters of diameter. Here in Peru, the market does not require such diameters, but in Chile, the needs at El Teniente match perfectly the capabilities of the SBM 700 SR.

How is raise boring technology changing?

There is a trend for more automation and remote control. However, in previous experiences to remove the human contact with the machine, operators do not take care of the equipment. In Australia they saw that remote-controlled scoops were less productive than those that were manned. While I see raise-boring moving towards automation, I do not see it becoming completely robotic.

What is the image of Peru as a manufacturer of specialized, underground mining equipment?

There are not a lot of manufacturers of heavy equipment in Peru. There is Resemin and there is us. When we have the opportunity to put 'Hecho en Perú' on our piece of equipment, I feel the sense of camaraderie with Peru. Peru is known for tourism, agriculture and food. I hope that we can help change that mentality to add our industrial capability and manufacturing. When we put the Peru flag on our machines, it makes all workers proud, and it makes me proud. —



EQUIPMENT & TECHNOLOGY



“Most of the limitations we had a few years ago to introduce fleets of autonomous trucks have been overcome. Today, there is a mine in Chile that runs with a fleet of 100% autonomous trucks from Komatsu, with the navigation system from Modular. Peru has a great opportunity to progressively incorporate this technology: indeed, we already have requests to start analyzing this possibility in three operations in the country.”

- José Marín,
CEO,
Komatsu Mitsui Maquinarias Perú

Image: Komatsu M.M.P.

Equipment Providers

Technology development never stops

From some of the largest open-pit mines in the world, to narrow-vein underground operations, Peru is an excellent market for the whole range of mining equipment. On the larger end of the spectrum, Caterpillar will now have a bigger competitor in Komatsu, after the Japanese multinational decided to buy Joy Global for \$2.9 billion plus debt. Beyond these two giants, other brands are also starting to focus on the Peruvian market, such as Hitachi and, more recently, Liebherr. The German manufacturer, that has already gained market share in Peru's construction business with its cranes, expects its 400 short ton (363 metric ton) mining truck, the T 284, to make a difference over the next

years. "The T 284's electrical traction allows the truck to quickly get out of the pit through steep slopes, making sure that the equipment does not suffer and that fuel is used efficiently. As mines process more volume, using a smaller payload truck would increase congestion and push haulage costs up," said Carlos Ballesteros, Liebherr's sales manager for mining. Ballesteros affirms that the Peruvian market has shown an outstanding performance in terms of its constant acquisition of large mining trucks over the last years: "Since 2012, Peru's market for mining trucks of more than 100 short tons has consistently been above 50 units per year," he said. In the 400 short-ton payload capacity range,

the T 284 will have to compete with the Komatsu 980, which is going to start tests in Peru's high altitude conditions, and the more established Caterpillar 797F, of which there are 100 units already operating around the country's mines. Mariela García de Fabbri, CEO of Ferreycorp, the holding that represents Caterpillar in Peru, summarized the importance that new technologies are playing in today's mining industry: "Besides improvements in the size of the equipment, we are currently in the era of the Internet of things; which Caterpillar has called *The Age of Smart Iron*. We are working very closely with Caterpillar to enhance the connectivity of the equipment." ▶ 89



Image: Ferreyros / Beto Santillán

Mariela García de Fabbri

CEO
FERREYCORP



“

The 797F truck, with a payload capacity of 400 short tons, is celebrating five years of operation in Peru. There are 100 of them in the country, as part of a fleet of more than 600 Cat trucks.

”

What are the main areas of focus of Ferreycorp?

Ferreycorp is a leading holding in the provision of capital goods and related services in order to meet the needs of the different economic sectors in the countries where we operate. We are present in large-scale mining, underground mining, and infrastructure projects, as well as urban construction, sanitation projects, power generation, fishing, agribusiness, transportation and logistics. Ferreyros, the leading brand in the corporation, provides the Caterpillar heavy machinery in Peru, included off-highway trucks and shovels, and other allied brands; Unimaq sells light equipment for urban construction; Orvisa provides equipment needed in the jungle region; Ferrenergy supplies energy, provided by Caterpillar generators; Motored sells automotive trucks; Cresko imports Asian equipment; Trex sells cranes; Mega Representaciones sells lubricants, tyres and other consumables; Fiansa is a metal-mechanic plant; Fargoline and Forbis are logistics companies; and there is also Sitech, a young company that identifies technological solutions for our clients' operations. We are present in Peru and other countries in Central and South America. Altogether we had sales of \$1.7 billion last year.

You have represented Caterpillar since 1942. What are your market strategies in front of new competition?

Caterpillar has a unique business model of working with very well established distributors worldwide. We have a long-term vision that determines significant and continuing investments. Some brands have seen Peru as an attractive market, but as soon as investment levels in the country decrease, they lose momentum. We, as dealers, are fully committed to the territories we control and fully committed to the mining industry. As an example, we are now investing in a second component repair center (CRC) in Arequipa for Ferreyros. On top of that, we have around 2,000 technicians in Peru to support our clients.

What are your key products for mining?

The 797F truck, with a payload capacity of 400 short tons, is celebrating five years of operation in Peru. There are around 100 of them in the country, as part of more than 600 Cat trucks, of a wide range of capacities, delivered in the country. The 7495 shovel, the

biggest machine of our portfolio in Peru, is a great match for the 797F truck. In 2015, we also brought the first two Caterpillar electric trucks (794 model). Caterpillar has been in surface mining for more than 40 years. In underground mining, Peru is the largest market for Caterpillar's underground loaders: we have already sold 600 of them. Caterpillar invests heavily in R&D. Besides improvements in the size of the equipment, we are currently in the era of the Internet of things; which Caterpillar has called 'The Age of Smart Iron'. We are working very closely with Caterpillar to enhance the connectivity of the equipment. In fact, Ferreyros has developed strong condition monitoring capacities in this area, with teams of experts devoted to monitor items, such as the large trucks operating nationwide, to plan maintenance in advance and identify areas of improvement. Also, Caterpillar has a strong focus on reducing carbon emissions, making repairs friendlier, and reducing health and safety risks. On another note, Caterpillar is improving technologies for object detection and there are some Caterpillar trucks running autonomously. Depending of the miners' acceptance, there may be a trend towards autonomous operations in the future, both for open pit and underground. In the same way that cars will be driverless sooner than we think, this will also be a reality available in mining.

From a Ferreycorp perspective, how do you see Peru's future?

Over the last three years we have seen peaks of mining investments, with around \$7 billion spent annually. In 2015 and 2016 that rhythm has slowed down, yet we strongly believe that mining is here to stay, at least for the medium term. We are optimistic about the future of the industry in Peru, where there is a project portfolio worth \$60 billion. In 12 to 18 months, with just one or two announcements for new large projects, we will be again in a great growth position. Together with that, the country needs large infrastructure projects, as the deficit is estimated at \$150 billion. Peru's new president has stated that he wants to be remembered as a leader that modernized the country. Ferreycorp, as a holding with significant presence in the extractive and infrastructure industries, with the Caterpillar brand and portfolio, and with the other subsidiaries, is ready to contribute to the development of our country, as we have done for the last 94 years. —

José Marún

CEO
KOMATSU MITSUI
MAQUINARIAS PERÚ



How does KMMP manage its different businesses?

Komatsu Mitsui Maquinarias Perú is a joint venture between Komatsu (40%) and Mitsui (60%). Komatsu is represented through Komatsu in Chile, where Cummins is also a shareholder. Peru is one of the key countries of interest for our shareholders thanks to its growth in mining, construction and energy, which are the main industries for us. In mining, we want to keep our dominant position in the large mining trucks market, where we have a 68% participation in equipment with payload capacity over 300 short tons. Overall, we have more than 300 trucks operating around the country, so we need to have a strong after-market offering, in three main areas: spare parts, main components and services. We can serve clients through MARC contracts or other sorts of relationships. We are currently expanding our logistics center in Callao through a \$3 million investment.

How do you expect Peru's mining market to evolve?

Peru's mining market is going to keep presenting opportunities, especially in those operations that just started or those who are going through expansion programs. Southern Copper is going to expand Toquepala and Cuajone; Cerro Verde has just completed its expansion; Constancia, Antapaccay and Las Bambas are fairly new mines; and there are developments in Antamina and Toromocho. With this market, as miners repay their investments they will start dedicating capital to new equipment. Our advantage there is that we have a product that is totally proven and that offers the highest productivity, reliability and mechanical availability.

We have 92 trucks in Antamina, 12 of which have been recently added to the fleet; we have 38 trucks in Las Bambas and we are delivering six more this year; we also have trucks in Antapaccay, Bayóvar, Shougang, Toquepala, Cuajone and Lagunas Norte. In Cerro Verde, we do not have new equipment, but we are working strongly with the client to provide rebuilt trucks.

There is space for different brands in Peru, but mining companies are very structured and will only accept a new brand if the performance parameters can bring improvements to the table. The good thing about Peru is that it has an open economy, which generates opportunities for newcomers, but forces incumbents to be more productive and efficient.

What are the main developments in terms of your product portfolio?

We are about to bring the first two Komatsu 980 trucks, with a payload capacity of 400 short tons. These trucks are proven in the North American market, especially in Canada, and we are now going to test them in altitude conditions. We are sure that their performance is going to be very good.

How has technology evolved, and do you think Peru will see a fleet of Komatsu autonomous trucks?

Technology has evolved a lot. Today, we have a dynamic dispatch system that assigns each truck to the particular shovel that will make the system more efficient, depending on the traffic. Before, each shovel would receive the same trucks all the time. This system has existed for years and is actually a predecessor of Waze, which is used by the wider public today.

With regard to autonomous trucks, most of the limitations we had a few years ago have been overcome. Today, there is a mine in Chile that runs with a fleet of 100% autonomous trucks from Komatsu, with the navigation system from Modular. Peru has a great opportunity to progressively incorporate this technology: indeed, we already have requests to start analyzing this possibility in three operations in the country. Besides, Komatsu trucks and Cummins engines have satellite communication systems that let us monitor their performance and health in real-time. This is working very well already. The same applies to our construction equipment. Finally, another key development has to do with the Internet. Up until now, the Internet has been mainly a commercial and social network. The new era is the industrial Internet: to be able to operate plants and equipment online.

What is your focus on training and capacity building, and how can communities benefit from that?

We currently have 1,800 people. We have a permanent program to develop technical capacities in-house, while we work very closely with Senati as well. Recently, I attended the graduation of new technicians in our MARC contract in Bayóvar, with people from the area of influence of Sechura and Piura. We will continue to work on these programs to help our clients and provide opportunities for the local communities. Also, we have now implemented an initiative in the framework of TEC (Technical Education for Communities), a Cummins program that Komatsu has joined recently. The first TEC program in South America is taking place in Arequipa. —

◀ 86

"Caterpillar has a strong focus on reducing carbon emissions, making repairs friendlier, and reducing health and safety risks," García de Fabbri continued. "On another note, Caterpillar is improving technologies for object detection and there are some Caterpillar trucks running autonomously. Depending on miners' acceptance, there may be a trend towards autonomous operations in the future, both for open pit and underground. In the same way that cars will be driverless sooner than we think, this will also be a reality available in mining," she concluded.

José Marún, CEO of Komatsu Mitsui Maquinarias Perú, pointed out that a fleet of autonomous trucks by Komatsu is already running in Chile. He gave his point of view on how technology development has dramatically improved operational efficiency: "Today we have a dynamic dispatch system that assigns each truck to the particular shovel that will make the system more efficient, depending on the traffic. Before, each shovel would receive the same trucks all the time. This system has existed for years and is actually a predecessor of Waze, which is used by the wider public today."

"Another key development has to do with the Internet," said Marún. "Up until now, the Internet has been mainly a commercial and social network. The new era is the industrial Internet: to be able to operate plants and equipment online."

While large trucks are getting larger and smarter, the same applies to shovels, which are growing in size to match the capacity of the larger trucks. Caterpillar, for instance, has the 7495 model to match the 797F truck; Liebherr has its R 9800 model; and Joy Global has the 4800XPC, with a payload capacity of 135 short tons.

According to Carlos Fonseca, general manager of Joy Global in Peru: "The 4800XPC is almost a proven product because it is similar to a 4100XPC but with a bigger capacity."

Fonseca also discussed the impact of the 2650CX hybrid excavator, one of Joy Global's latest developments: "It is a rope shovel without a cable; a hydraulic excavator with less hydraulics than a standard hydraulic excavator. It is diesel-electric with technology to capture the energy generated and re-use it to reduce diesel consumption. It will be very interesting to see this product enter the surface mining segment and compete with hydraulic shovels." —



ALWAYS INNOVATING IN
MINING

Equipment designed for increased productivity,
energy efficiency, safety and ergonomics.

www.atlascopco.com.pe

Sustainable Productivity

Atlas Copco

Carlos Fonseca

General Manager
JOY GLOBAL



What is Joy Global's positioning in the market?

Joy Global has suffered from its reliance on underground coal operations, especially in the United States, where the industry is coming under pressure. We have a strong drive to diversify away from coal, and copper is one of the areas of interest. We have 28 shovels, 12 loaders and 19 drills operating in different mines around the country. In Peru, diversification also means that we are focusing a lot on underground, hard-rock mining. Joy Global recently acquired MTI in Canada and Montabert in France, which positioned the company very well. Finally, we have our service center in Arequipa, where we have invested \$40 million. We have a structural, mechanical and electrical shop there, and we have made the switch from simply selling equipment to servicing it full time.

Technology-wise, what are the main developments coming from Joy Global?

We already have a shovel with a payload capacity of 135 short tons, the P&H 4800XPC, which is almost a proven product because it is similar to a 4100XPC but with bigger capacity. Also, on the surface side, we have the 2650CX hybrid excavator, which is currently operating at a trial site in the US. It is a rope shovel without a cable, a hydraulic excavator with less hydraulics than a standard hydraulic excavator. It is diesel-electric with technology to capture the energy generated and re-use it to reduce diesel consumption. It will be very interesting to see this product enter the surface mining segment and compete with hydraulic shovels. With less hydraulics, what you get is a lower total cost of ownership (TCO). Also, we are taking this hybrid technology, which we acquired from Letourneau, to underground machines.

What role is the La Joya service center going to play in terms of your service offering?

The La Joya service center is a state-of-the-art facility with technology that does not exist elsewhere in the country, and highly trained personnel. We know that we are a new player with a Rolls-Royce but we cannot charge Rolls-Royce prices, so we are focused on getting customers in and driving volume. Besides our infrastructure, our approach to service is special: we have a components-exchange program whereby we provide a motor or a dipper for your equipment while we repair the other one, so that we minimize the downtime. I do not think that non-original equipment manufacturers can compete with our components exchange program, because we focus on reducing the TCO. —

Carlos Ballesteros

Sales Manager
LIEBHERR



Could you give us an overview of Liebherr's business worldwide?

Liebherr is a company with global revenues of over 9 billion euros, with 130 subsidiaries around the world, and 45,000 employees. In Latin America, we are present in Colombia, Chile, Argentina, Brazil, and Peru, where we opened our office in 2014. Setting up a local team in Lima was a big milestone for the company; from Lima we handle the mining business and the mobile cranes business.

How do you plan to enter the mining business in Peru?

For the mining business, our aim is to develop the market for our mining trucks and shovels in large mining operations. We do not have any trucks in Peru at the moment, but we have a good track re-

cord in Brazil and Chile, where we have a combined fleet of around 70 trucks in operation. With this in mind, we see many opportunities to enter the Peruvian market. Our 400 ton (363 mt) truck is the result of great technological innovation over the last years. It is a great solution for big mining operations today, that are looking for bigger efficiencies. Right now, only two brands dominate the market for big mining trucks in Peru, so we see windows of opportunity where Liebherr technology can bring efficiencies to the table.

Besides its ability to transport high volumes, what other advantages does Liebherr's T 284 offer?

The competition cannot offer the same diesel-electric, highly efficient 400 ton trucks. The T 284's electrical traction allows the truck to quickly get out of the pit through steep slopes, making sure that the equipment does not suffer and that fuel is used efficiently. As mines process more volume, using a smaller payload truck would increase congestion in the mine and therefore push haulage costs up. With the T 284 we can offer less trucks for the same payload, which equates to a lower cost per ton.

How long do you think it will take you to sell the first units?

We expect to have some tests with clients soon, and we are very confident the results will be favorable. The moment we bring the first truck, we will invest in the after-market support teams in the mines as well as the related infrastructure, such as workshops, storehouses, etc. We are in the process of evaluating our options in this respect. —

Brian Doffing

General Manager
ATLAS COPCO



How has business changed in the current mining cycle?

The aftermarket segment has strengthened as a percentage of our business. Over the progression of last year, we increasingly saw customers looking at how to lower their cost per meter or cost per ton, rather than acquiring new equipment. For some of our key customers we are offering a business model whereby they are not buying the equipment but paying for its use. For us there is more inherent risk, but clients have asked for our support in the current market. Then, in some mines we also have consignment contracts for consumables, so clients have the parts or tools available and it aids their cash flow. What I am curious about is if, three years from now, we will go back to the previous model or if we will keep this operations-based model. We will always adapt to what works best for our clients.

What are the latest news on the R&D front?

We have brought a lot of simulators to train our technicians, who are our first line of service. Without good technicians, there is no reason to introduce new technology. We are going to have a temporary training center here but we are planning to open a sizeable training center in the country. We are focusing on our technology platform. Computerized equipment can give you more accurate drilling, accurate loads in the scoops and more efficiency in general. At a corporate, macro level, we see that mechanical rock excavation will increas-

ingly replace drill and blast. What I have observed here, looking at some large civil infrastructure projects such as the Lima Metro or the Alto Piura irrigation project, is that they are moving more towards the tunnel boring machines as opposed to the machines we, or our competitors, would offer. Of course, the problem of these large machines is that, if you have a problem with them, you have to stop the operation completely. We are doing a test in Chile in a mining project where, instead of using a scoop and a drive-and-load method, we are using a Häggloader that has arms to feed the conveyor. We need to confirm if this method could be a good solution in underground mining.

Is there a trend towards bigger scales in underground mines?

We recently had a delegation from Votorantim; they went to Cerro Lindo because that mine is one of their flagships for technology advancement. For instance, they have the M4C with total ABC (Advanced Boom Control), where the pattern is loaded in, and the operator can sit back and do other work (or have a coffee!) while the machine drills the long holes. Cerro Lindo is one example of underground mining going larger, but you still have many companies in Peru going for small equipment and working on narrow veins.

In Canada, Australia or the U.S., you mostly find large scale, whereas in Peru you have a diverse market. It is an evolving market though; you have mines that

are moving fully towards mechanization. Condestable is not using as many hand-held drills anymore, for instance. It is not just about the size of the operation, but also about safety.

How can you contribute to better safety standards?

From a product standpoint, it is about getting the operator only as close to the face as they need to be. There has been a lot of discussion about tele-remote systems; most of our clients in this space have come from surface mining. Safety standards have not gone down, but probably the investment in these new technologies is being delayed by the market situation. However, I can say that there has been a huge investment by mines countrywide in terms of the implementation of safety programs.

What are your short-term goals?

We see that production has contracted. If you look at the importations of equipment and consumables in the country, they have gone down. We see that capital expenditures are going to stay low. We are budgeting an 8% growth in the service business in 2016, and a 5-6% growth in the consumables business. Since the market has contracted a little bit, we will try to capture more market share. If metal prices stay where they are, some companies may start to come out of hibernation by the second half of 2016. Exploration has been soft, but we are hearing from the contractors that it is picking up a little bit. —

Marcus de Monzarz

Country Manager Peru &
Vice President Sales Andean
SANDVIK



What are Sandvik's main product lines?

Originally, Sandvik was a steelmaking company, and with that background we have the complete range of mining tools. In surface mining we have drill rigs up to a certain size. We also have a line of crushing and screening, including primary, secondary, and tertiary crushing. Underground mining is one of our core areas of revenue, because we have the full offering for it. We also have the full offering of equipment for exploration, both surface and underground. Underground we have all the underground drills, loaders, trucks, crushers and screens. On top of this, we offer automation solutions for different lines of equipment to increase productivity and enhance safety. 85% of our business is with the mining industry, and the remainder comes from construction. We have a presence in 21 locations countrywide.

Could you mention a particular success case of Sandvik in Peru?

A team of Milpo managers had the chance to come to one of our factories to see our LH621 loader, which works in 6-meter sections and can carry 21 metric tons (mt); it is the biggest loader in the world. Milpo bought three of them and also two LH514, which is a smaller version. They decided to buy our loaders based on the good results that they could see in terms of the cost per metric ton.

Every mine is different. How can Sandvik's units adapt to each of them?

If a unit is electrical or not, if it has electronic components or not, that depends on the infrastructure of the mine. We would always want the best technology in every mine but perhaps there are issues with ventilation, altitude or access to power. The trend is that if you have power infrastructure, you will work with batteries: you reduce emissions, you reduce the cost of moving fuel around, you reduce ventilation costs and maintenance is much more efficient. For this, we need to invest in R&D constantly. Automation also favors the durability of the equipment, with proximity detectors that prevent crashes and remote-control systems to improve safety. The focus is on those new technologies, but ultimately it is the customers who decide the sort of machine that they need for their mines.

Therefore, we are focusing more on the after-market business, in terms of spare parts and maintenance.

What other business opportunities are you tapping into?

We have equipment and tools dedicated to mining production, especially in tunneling-related activities, and this business has kept a good shape. Mining companies have continued producing minerals. We also have products for infrastructure and environmental projects, which we are pushing strongly as part of a diversification effort to our non-traditional markets.

Could you give us more information on some of your flagship products?

We have a manual drilling rig, the pneumatic S250, that is used in mines that have not mechanized their processes. Then, we are very strong in terms of the production steels, especially in long-hole drills. In terms of drilling rigs, we have rigs for surface and underground operations. We are now introducing sonic drilling technology, which is vibration-based and does not require water or drilling fluids, so the quality of the sample is outstanding. With sonic drilling you get a very low drill deviation of less than 1%, you reduce waste by up to 80% and you can drill twice as fast. It is a method that is used a lot in tailings dams. It also has geotechnical applications for infrastructure and environmental projects. In Chile this technology has already been used for the last years, but in Peru it is something new.

Components and spares

The operations-based model

The larger installed capacity in the country as a result of last years' investments, and the more recent reduction of capital projects, have resulted in a stronger focus on the after-market segment. According to Brian Doffing, general manager of Atlas Copco: "Customers are increasingly looking at how to lower their cost per meter or cost per ton, rather than acquiring new equipment. We are offering a business model whereby our clients do not buy the equipment but pay for its use. We also have consignment contracts for consumables, so clients have the parts or tools available and it aids their cash flow. What I am curious about is if, three years from now, we will go back to the previous model or if we will keep this operations-based model."

In the current scenario, after-market support is the strategy adopted by all the new players in the market (such as Joy Global

with their underground offering) and non-OEMs in order to keep up relationships with mining companies.

Austin Engineering, an Australian manufacturer of truck bodies that owns the Westech brand, entered Peru with contracts for Las Bambas and Antapaccay, and is now taking advantage of this market presence to capture service contract opportunities.

Tim Mitchell, general manager of Austin Engineering in Peru, explained that mining operators do not necessarily tie themselves to traditional OEMs: "We are proud to be the only manufacturer in the world that has been able to deliver a non-OEM tray for new Caterpillar 797F trucks."

The company is also working to improve the efficiency of existing running fleets, with issues such as the 'carry back', very common in North America and which also affects some mines in Peru (see interview on next page).

Esco, another manufacturer of highly engineered parts, wants to be ready for the next mining boom; for that, it made a greenfield investment in a new manufacturing facility in Chile to cover the regional market. Juan Parra, managing director of Esco, said: "We are focused on improving our technology. We are working on new products that are going to be a breakthrough in terms of its design, performance and durability. We are going to present those during Minexpo at Las Vegas."

Sergio Cepeda


Sales Director-Products
BOART LONGYEAR




How are you adapting to the crisis in the exploration segment?

Mining companies have cancelled some greenfield projects in order to focus on the brownfield investments and, within brownfield projects, there are two scenarios: you have companies that cannot stop exploring because they need to replace their reserves, and those companies that have bigger reserves and prefer to put their exploration dollars on stand-by for a while.

In Peru there are many underground mines that cannot afford to stop exploring. In general, large and medium sized mines have continued their activities, but if you look at the overall volumes, we estimate that less than 30% of the drilling rigs in the country are working, as opposed to over 80% a few years ago. This is affecting us because today it is much more difficult to sell new rigs.



Presenting Our Line of Products for Underground Mining Equipment



Products: Trays / Buckets / Water Tanks / Service Modules / Cable Reels / Tire Handlers / Repair and Maintenance Services

Calle Los Tulipanes No. 147, Edificio Blu Building, Oficina 901, Piso 9, Santiago de Surco, Lima 33 Perú
Tel: +51-1-634 4400 Email: ventas@austineng.com.pe www.austineng.com.pe

Tim Mitchell

General Manager
AUSTIN ENGINEERING



What has been the evolution of Austin Engineering in Latin America?

Austin Engineering is an Australian company with business units in Australia, Indonesia, the United States, Chile, Peru and Colombia. We have two design houses: one in Perth, Australia, identified by the brand JEC, and the other one is in Wyoming, U.S., that has its own brand, Westech. We started our operation in Peru in 2012, thanks to a large contract with Xstrata Copper for truck trays for Las Bambas and Antapaccay. We bought two business units of a local company, which included a manufacturing plant in Lurín and on-site welding contracts. Since then, we have invested to expand our production facility and have acquired some land where we will construct a new manufacturing plant.

The large contract with Xstrata resulted in two new relationships with Glencore and MMG. Was that a good transition?

The change was smooth. Las Bambas is owned by MMG, an Australian-based company like Austin Engineering. We not only delivered more than 40 truck trays

for them, but we are also engaged in a service-welding contract that started mid-2015. With regard to Antapaccay, it is now owned by Glencore, and we have been able to secure further work with them. We are now delivering tray number 16 for a new fleet of Caterpillar 797F trucks they have acquired. At Austin Engineering, we are proud that we are the only manufacturer in the world that has been able to deliver a non-OEM tray for new Caterpillar 797F trucks.

What is your relationship with the original equipment manufacturers (OEMs)?

Caterpillar is generally very strict in terms of installing their own trays, whereas other brands, such as Komatsu, Hitachi, and Liebherr, are quite open to offer different bodies according to the needs of the client. We always look at optimizing the tray based on specific parameters including the weight of the tray, and in the majority of cases, our tray is lighter than the design provided by the OEM. We recently sold trays for a client that had problems with 'carry back' in the OEM trays. This problem occurs when the material sticks at the back of the tray, so there are 5 or 10 tons that they carry back and forth, wasting payload. Westech has had a lot of experience reducing the carry back in the cold, sticky environments of North America and Canada. Hence we have been able to provide a customized solution, which will reduce the problem of carry back to this client.

What other products do you offer besides trays, and how are those being received in Peru?

We are the largest non-OEM supplier of truck bodies and specialized products for mining equipment. We have over 10,000 truck bodies operating around the world, but we also have many other products: excavator buckets, face-shovel buckets, water tanks, service modules, product-

loader buckets, stemming buckets, tire handlers, cable reels and others. Locally we have sold a number of water tanks, mining buckets and large rope shovel dipper with a capacity of 100 tons. We also sell smaller buckets for excavators and front-end loaders, from 4 to 40 cubic meters in capacity. The smaller units are for construction activities, and also over the last year we began turning our attention to underground mining components where, having local design capabilities, we could offer faster response times for customized components.

Are OEMs increasingly competitive in the after-market business?

Equipment companies are already tying the sale of their products to heavily discounted spares and maintenance contracts. OEMs have constructed larger facilities to capture the whole market. Certainly, it is a challenge for us to compete with companies this big, but being on-site and having direct access to the client you have the opportunity to be the first point of call. We have done it successfully in Chile and Colombia, and in Las Bambas we have placed a design engineer, so the client can receive added value and immediate improvements to their equipment.

What opportunities do you see to capture a bigger share of the market?

We have been very successful with Southern Peru Copper, a company traditionally very aligned to OEMs. For the last two years, they have acquired all of their replacement trays from Austin Engineering. There are opportunities, but the market is highly competitive. Also, Peru has a very different philosophy to other countries around the world. In Australia, miners will buy a tray and will scrap it after three years to buy a new one. In Peru, clients want a tray that can be continuously repaired for a much longer life, thus the tray must be more robust than in Australia. —

Juan Parra

Managing Director -
Spanish Speaking Latin America
ESCO



Could you give us an introduction into Esco Corporation?

Esco is a private company that was established in 1913 in the United States. We have a privileged position in the market of highly engineered wear parts and replacement products. We have 4,000 employees worldwide, and mining is our most important industry, mainly surface mining. In Peru, we work with most of the country's large mines, like Yanacocha, Barrick, Southern Copper, Antamina and Cerro Verde. In Yanacocha we actually have a service contract with 100 people providing welding and repair services.

What is your manufacturing capacity in the region?

We have a plant in Chile to cover the South American market with a capacity of 25 metric tons per day, although today we are working at levels of 15 mt/d. It is a moderate scale, but if there is a

boom in the market we could expand our capacity to 60 mt/d. We want to be ready to have enough capacity in case the market picks up again to 2006-2008 levels.

What is your relationship with the original equipment manufacturers?

In some markets, we work hand in hand with the different OEMs. In other markets, we compete. Most of our products can fit into the large machines made by the large OEMs like Caterpillar, Liebherr, Komatsu, Hitachi and Joy Global. Our main products are the wear parts for very large equipment. We have some pieces that have a loading capacity of up to 160 cubic yards, so we are talking of big products that have a lot of engineering and development behind.

What are Esco's competitive advantages?

We are definitely not the cheapest option for the products we sell, but we have the best technology for steel durability. Sometimes clients tell us that they have found a cheaper alternative to our products, but once we do the performance tests, Esco is more reliable. Some mines offer very challenging conditions in terms of the hardness of the rock, and this is where Esco has a competitive edge.

With the growth of the industry, new players have entered the market. Business owners with a small foundry have gone to China and created new brands without the required quality. After so many tests over the last years, the miners are only giving a chance to companies that can offer some real value. —

Thorstern Körner

Sales Manager
BOSCH REXROTH



What is Bosch Rexroth's positioning in the mining sector?

We are the main player regarding the mobile applications in the mining industry. For instance, one of our biggest clients is Caterpillar, so almost every model from Caterpillar has Bosch Rexroth hydraulic components; the same goes for other original equipment manufacturers (OEMs). Besides, we do not only offer components, we offer the complete systems for mobile applications: we have hydraulic systems that communicate electronically with the diesel motor, for instance. The other sector where we are present is the industrial applications, where we work with almost every manufacturer. Since the beginning of 2014, we have seen higher growth levels than expected, thanks to our relationship with local OEMs such as Resemin. The big overhaulers have also grown a lot since last year: we can supply them with every component to replace anything

that is not Rexroth. We have also been able to work with important EPCM companies through our distributor, Maestranza Diesel, where we have sold spare components for large projects like Toromocho, Las Bambas or Antapaccay.

What has been your relationship with the big capital projects?

In Peru we do not deal directly with the large capital projects: the deals are done by Bosch Rexroth internationally. However, once the equipment is working at the mine, clients need service and spare parts, and this is where we come in: we have been very successful in this respect, to the point that the regional business unit has decided to expand our scope. We are planning to at least double our sales figures over the next year.

What trends do you see in the equipment industry?

We have seen an increased use of electronics in the equipment, which is very positive for us. As we have seen in the automotive industry, there are many new systems that increase efficiency in mobile applications. The local OEMs are a bit reluctant to incorporate so much electronics; they prefer hydraulic and even mechanical controls in some applications, but from our perspective, electronics will be increasingly present in the mining industry. It is not possible to keep up with the regulations just with mechanical components, for instance when it comes to pollution control.

Hydraulically, the technologies are already quite developed; where there is space for improvement is in the control systems, for example traction control, force distribution in mobile equipment, cooling systems, breaking systems and other aspects. —

Ancillary Equipment

Beyond the huge trucks

When talking of 'mining trucks', it is typically the huge haulage equipment that comes to mind. Mining companies, however, also need a fair amount of trucks for complementary jobs in the operation, mostly related to infrastructure development. In smaller payload needs, brands like Volvo and Mercedes-Benz play a key role in Peru's mining industry. In 2013, Peru was the largest market worldwide for Volvo's FMX model, and, even if today the market has contracted, this truck continues to be a key driver for the company. The latest evolution of the FMX was launched in late 2014. "A very important new feature for the mining sector is the I-Shift automatic gearbox with an ultra-light crawler gear which we are launching this year. This provides exceptional startability for heavy-duty trucks in steep inclinations, reducing fuel consumption. There is a strong trend towards the I-Shift in the market, as opposed to the

“

Although today the demand for trucks is supported by the good health of the internal consumption business, the mining industry will always be fundamental for Peru's development.

- José Antonio Heredia,
Manager Trucks Division, Divemotor

”

mechanic gearbox,” explained Marcus Hörberg, managing director of Volvo Peru. While several Asian brands have entered Peru's market for heavy duty trucks, premium brands still keep an edge. Also, as of this year, Volvo can offer the synergies of handling Volvo Construction Equipment's business, previously in the hands of a distributor. With regard to Mercedes-Benz trucks, the business is handled in Peru by a local distributor, Divemotor. Operating mines that are using Mercedes-Benz's Actros model include Vale's Bayóvar phosphate operation and Aruntani's gold operations. Like Volvo, which is investing to expand its service network in the country with new shops in Pucallpa and Chiclayo, Divemotor is also opening up new centers in Cusco, Piura and Arequipa. José Antonio Heredia, manager of Divemotor's truck division, underlined the importance of a large service network: "Sometimes a vehicle of a certain brand offers some technical advantages, but if you do not have the right support and the truck needs to stop for a day, those advantages just vanish." —



**Volvo Construction Equipment
ahora forma parte de las
soluciones de Volvo Perú**

Renovamos nuestra confianza en el mercado peruano con la incorporación de Volvo Construction Equipment a la familia de Volvo Perú. Desde marzo nuestros clientes tienen una solución aún más rentable, reduciendo sus costos operativos.
Volvo tu mejor socio de negocios.

Volvo Perú S.A.
Carretera Panamericana Sur Km 23.88 - Lurín
Telf.: (01) 317 1200
www.volvo.com.pe



Marcus Hörberg

Managing Director
VOLVO

What have been the major milestones in Volvo Perú over the last years?

The total market for heavy-duty trucks has contracted for three years in a row. Last year, a total of 6,400 units were sold in the country, according to the Peruvian Automobile Association (AAP). For us though, things have been going well; we have kept our market share and leading position with the Volvo trucks, and we have increased our market share with the Mack trucks for the third consecutive year. We have also grown our presence in the bus market, where we are involved in the commuting of mining workers to the operations. The big news this year is that we are taking over the Volvo Construction Equipment business, previously handled by a distributor, which includes the Volvo and SDLG brands. This is going to generate very interesting synergies because we can now offer the whole range of products for mining and construction.

Have you launched any new models recently?

We have launched a full new range of Volvo trucks over the last years, including a new FMX in late 2014 and a new FH. We have introduced the full-range FM on-road, which is a new product, although it is not so connected to mining. With regard to the new FMX, it incorporates several technical improvements, on top of a more powerful engine of 480 horsepower as opposed to 440 hp before.

We have also introduced our Dynafleet telematic solution for fleet management, which can be used with all Volvo truck models. Customers can monitor and mea-

sure aspects such as the performance of the drivers, the positioning of the units and the fuel consumption. Finally, a new feature that is very important for the mining sector is the I-Shift automatic gearbox with an ultra-light crawler gear, which we are launching this year. This provides exceptional startability for heavy-duty trucks in steep inclinations, reducing fuel consumption. There is a strong trend towards the I-Shift in the market, as opposed to the mechanic gearbox.

How much are you investing in your service infrastructure?

Since we have by far the largest running fleet of Volvo Trucks in Peru, we have the largest and most competent network with the highest parts availability. With the inclusion of Volvo Construction Equipment, we can provide a more complete service to our customers, either on-site in the mining operations, or in our shops around the country. Our most recent additions to the network have been Pucallpa and a renewed workshop in Chiclayo. Soon we will inaugurate a new workshop in Huancayo and there are more service network investments to come.

As miners focus on reducing costs, how can you help them in this respect?

The cost consists of several elements. The price of the truck is just one aspect, and in if you only look at that, we are never the cheapest option. However, Volvo trucks sell at much higher prices at the second-hand market, which makes the lifecycle cost of a Volvo truck very competitive. This is the result of the quality of the prod-



uct, but also of the low levels of downtime, thanks to the high availability of parts and service centers. Uptime is extremely important for mining companies: they lose a lot of money when equipment is down.

What is Volvo's contribution to on-road and off-the-road safety?

Safety is one of our core values, together with quality and care for the environment. We continue with the 'Transformar' behavioral training program for drivers aiming to improve traffic safety and improve our customers' profitability. Responsible drivers will reduce traffic accidents and save on fuel and repair costs. At this stage we have trained more than 1,500 drivers. On the technology side, we have a significant range of safety related features like Alcolocks, systems to detect driver drowsiness, electronic stabilization systems, and much more. On the CSR front, we have a project called 'Stop, look and wave'. There are over 3,000 traffic-related deaths every year in Peru, so with this very simple but effective program where we want to raise awareness among children.

What are the prospects for Volvo in Peru's mining sector?

We already have a market share of close to 50% in mining, and we want to continue growing that. We will continue investing in our service network, and we will focus on the opportunities that Volvo Construction Equipment offers, in combination with our other business lines. Also, we will promote our Volvo Penta engines used for versatile equipment and power generators in the mining segment. —

Underground Equipment

Anticipating paradigm shifts in Peru and globally

Whilst Peru still has many underground mines that are operated using traditional, non-mechanized methods, the global manufacturers of mining equipment are increasingly turning their attention to mines below surface. Joy Global, recently acquired by Komatsu, has aggressive growth plans in underground hard rock mining after its recent acquisitions of MTI in Canada and drill manufacturer Montabert. The synergies created with the wider organization mean that the company can apply its hybrid technology, acquired from Letourneau, to its underground equipment offering. With regard to Atlas Copco, the Swedish manufacturer anticipates a paradigm shift in

underground mining development, according to its Peru general manager, Brian Doffing: "At a corporate, macro level, we see that mechanical rock excavation will increasingly replace drill and blast. We are doing a test in Chile in a mining project where instead of using a scoop and a drive-and-load method, we are using a Hägglöader that has arms to feed the conveyor." Atlas Copco is also focusing on improving its technology platforms to enhance efficiency. In Milpo's Cerro Lindo, for instance, the operator is using Atlas Copco's Simba M4C with total ABC (Advanced Boom Control), where the pattern is loaded in, and the operator can sit

back while the machine drills the long holes. Technology and knowledge transfers are fundamental to continuously improve efficiency and safety. Normet, a Finnish manufacturer of underground equipment with a strong presence in shotcrete application processes, has recently invested in a simulator in Lima to train operators without having to use real machines and real shotcrete.

Franklin Pease, Normet's general manager, developed on the huge impact that bad practices in shotcrete application can have on overall operating costs: "If a company uses 1,000 cubic meters of shotcrete monthly, at a cost of \$300 per cubic meter, this makes \$300,000 monthly. If 20% of that drops to the ground, you are throwing \$60,000 in the bin every month. This is the salary of quite a few people."

While everyone agrees that training is key to obtain the best results from the different machines, the low cycle has actually intensified the debate between those who want high-tech equipment and those who prefer sacrificing some of the productivity that technology brings to the table, in favor of short-term lower costs.

"Mining contractors prefer low-tech machines, while larger contractors and mining companies are more open to introduce new technologies. In times of lower metal prices, clients are focused on keeping a healthy cash flow by reducing operating costs and increasing productivity, but some clients also favor low-tech machines to do maintenance in house and save money there," explained Mario Lara, commercial manager for underground mining at Joy Global.

On top of the global players like Sandvik, Atlas Copco and Joy Global, underground operators also have the option of buying from Resemin, a Peruvian manufacturer that sold 42 machines last year to mines in Peru as well as other countries like South Africa, Canada, India, DRC, Argentina, Chile and Mexico. Resemin's motto is to build 'uncomplicated' machines.

James Valenzuela, CEO of Resemin, summarized the company's most recent news: "We have developed the Barycenter system for long-hole equipment that allows for a better synchronization of the drilling and rotation axles. We have also consolidated our market position by launching the Muki, which is the smallest jumbo in the world, designed to replace the manual pneumatic jacks and significantly reduce rockfall-related risks. We have sold 10 Mukis over the last 14 months." —

Franklin Pease

General Manager
NORMET



How can you help mining companies and contractors become more cost-efficient?

The oscillations of metal prices are very linked to speculation, exchange rates and other factors. For mine operators, the only truth applicable is that you need to keep the lowest costs. This business is not simply about having a cheap machine, but also about managing its usage and optimizing the whole process. We are constantly analyzing case studies from Finland, Canada and other locations in order to have the best results in the mine. Our job is to connect our local clients with other operators worldwide and generate benchmarking with other companies.

As an example, if a company uses 1,000 cubic meters of shotcrete monthly, at a cost of \$300 per cubic meter, this makes \$300,000 monthly. If 20% of that drops to the ground, you are throwing \$60,000 in the bin every month. This is the salary of quite a few people. Acceptable waste rates are 8 to 10%; if you are at 20%, there is room for optimization. On top of the wasted shotcrete, you are also spending more money on fuel, machines and people to transport that extra shotcrete around the mine.

What is the role that technical training has in this context?

We have invested in a simulator here in Lima so that operators can be trained without having to put real machines and real shotcrete in the process. In Latin America, only Peru and Chile have this simulator available within Normet. It is very important to raise the bar: In Peru, technical education levels are low. Training a technician is a long process that requires a lot of previous knowledge; it is much more than explaining to someone how a machine works.

On top of technical training, how can you add more value to your service offering?

We have invested heavily on stocks and we are storing spare parts within the mines or very close to the mines, in order to improve our response times. Machines can last 10,000 to 15,000 hours, but for that it is important to manage the maintenance programs with care. Probably our revenue is divided 60% from mining contractors and 40% from mining companies. We always advise our clients about the best models for each mine; we also adapt to the new mining scenario by providing rental alternatives, so clients can include that investment as part of their operational expenditures. Rental will be increasingly important in this business.

Besides mining, how important is the infrastructure market for Normet in Peru?

The country is going to need huge investments in infrastructure; we are going to need more roads, and that means more tunnels. The country needs more irrigation projects, and that will also require more tunnels to bring water to the coast. The country will keep investing in hydropower projects. Finally, in Lima we are already talking to some of the main contractors working on the new Metro lines. We expect to see business opportunities on all these fronts.

Do you think the use of liners will replace shotcrete at some point?

The liners offer quick resistance for temporary situations. The shotcrete takes longer to solidify, but it is a more durable solution. At Normet we have a liner solution called SSL. A good tunnel will use a combination of all these technologies to benefit from the technical capabilities of each. For instance, in some permanent tunnels, such as a road tunnel, you need to assure that the structure will be dry. There, you can inject some products before and after the shotcrete to increase impermeability.

How are Normet underground machines evolving?

Our machines evolve little by little; the latest models are the result of many years of experience in different working environments. Some of our models, like the Alpha 20, are very robust and basic, and now the key aspect is to make the most of them by providing more training to operators. Other more sophisticated models, such as the Alpha 30 and the Spraymec, keep evolving permanently. Our engineers are constantly improving the hydraulics, the electric systems, the electronics, the insulation and the carbon emissions.

What are your goals for the upcoming months?

We want to work with our clients to offer our new technologies such as the SSL and different products for water control; we want to help in the mechanization process in many areas, such as the hauling of explosives, the scaling process, and other jobs that involve lifting vehicles. Many underground operators and contractors are mechanizing their processes, which allows for better efficiency and personnel safety. Finally, we want to support clients with their logistics management in the mines. —

normet

FOR TOUGH JOBS

We deliver comprehensive solutions for shotcrete in both mining and tunneling. Our customers value that we provide equipment, additives for shotcrete, EFNARC certificate training, and training simulators for our robotic equipment, allowing our customers to optimize their processes thanks to a comprehensive support system. Our recently acquired shotcrete projection simulator is an important tool that allows to save operating costs and materials by reducing rebound from robot operators through constant training in a safe environment.

Av. Arboleda 425 | Lima, Santa Raquel – ATE Lima 3 | Peru | +51 1 348-4516
www.normet.com

James Valenzuela

CEO
RESEMIN GROUP



What has been Resemin's position over the last year?

2015 was a difficult year for mining companies and for most of the equipment providers. In the case of Resemin, sales were higher in 2015 than in 2014, thanks to the fact that we gained market share. Most of the revenue has come from capital projects, when other players have actually focused on *opex*-related sales. Companies are looking for lower-cost machines, but they do not want to lose productivity or high availability. This year we have consolidated some developments that we had moving from 2012. For instance, we have made our machines more reliable thanks to the installation of brand new components. We have developed the Barycenter system, which has its patent pending; it is a system for long-hole equipment that allows for a better synchronization of the drilling and rotation axes. We have also consolidated our market position by launching the Muki, which is the smallest jumbo in the world, designed to replace the manual pneumatic jacklegs and significantly reduce rockfall-related risks. Another important development has been the new design of the long-hole machines and the bolters, which are now more reliable. Finally, this year we are launching our first scaler.

What space do you have to grow in narrow-vein mines with the Muki?

We have sold 10 Mukis over the last 14 months. For a new machine it is a great success: Muki will become a model of reference worldwide because there is no other machine of its size in the market. It will play a key role in the modernization of old mines that use manual drilling methods with high risks for the operators.

What is your collaboration with specialized companies for the different components of the machines?

We have a good collaboration with Montabert, now owned by Joy Global. Two years ago they launched the most modern drill, the HC95, which is for drilling machines what the iPhone was for cellphones. We are very happy to work with them and with other technological partners that enhance the quality of our equipment.

What are the main demands from the customers?

Zinc was over \$2,000 per metric ton in 2012 and a few months ago it was around \$1,300.

So, it is understandable that mining operators are pushing providers to cut costs. We need to accept that these are the new rules of the market. Having said this, from my perspective, crises are good because things go back to normal. In the years of bonanza there was an enormous inflation in all aspects, especially labor costs. There were some extraordinary salaries being paid. Workers that made \$15,000 or \$18,000 monthly are now earning \$7,000 or \$8,000. Without discrediting the quality of the work of these professionals, that inflation was crazy.

You are positioning the Resemin brand worldwide. Which are your main markets?

Of the 42 machines we sold last year, an important number was exported to countries like South Africa, Zambia, Botswana, DRC, India, Mexico, Chile and Canada. We probably have just 2 or 3% of the world's market in underground drilling rigs, so we have a long road ahead to continue growing. Companies like Atlas Copco and Sandvik are the market leaders and we are following them. In jumbos for tunneling we have machines that offer similar performance to theirs. However, in long-hole drills, due to our R&D developments, we offer some technical advantages. Then, talking about roof bolters, our machines offer less complex technologies and that is an advantage as well. If something defines Resemin, it is that our machines have simple yet innovative designs, which is the favored option by the market right now.

How is the 'Made in Peru' received internationally?

For many, it is weird that a company like us has grown in Peru. Peru is a mining country and, as such, it is a good location to produce mining equipment. Yet it still surprises many people when they hear we are Peruvian. We believe that, after Atlas Copco and Sandvik, we are the third company in terms of units produced per year, and we are growing.

What are your goals for 2016?

This year, we want to grow by 20% and sell around 50 machines. In terms of models, we want to continue growing with the Muki, and we want to push the participation of the front face jumbo. Finally, we have to make an impact with the new scaler. For the longer term, we also have plans to enter the hauling business with new models, but it will take some time. We want to grow sustainably so we need to go step by step. —

Plant Solutions

Fine-tuning processes

Mobile equipment is not the only area where efficiencies can be obtained. With increasing volumes, processing plants are becoming true monsters where tiny scalable improvements can translate into large savings in the long run.

Grinding is a key area of focus, as explained by Javier Castro, general manager of Moly-Cop, an Australian-owned grinding media manufacturer: "20 years ago, the largest ball mills had maximum diameters of 16 feet and engines of 3,000 horsepower. Today, Semi-Autogenous mills can reach diameters of 42 feet and use 30,000-horsepower engines. The impact conditions inside the mills are much higher today so the product that was used 20 years ago would not have a good performance today."

Moly-Cop has recently launched a new product, the NG SAG ball, made of special alloys as defined by the company's R&D de-

► 103

“

We constantly look at how to reduce to the minimum the maintenance stops for the belts. We provide cleaning solutions that can be used even while the belt is working. This is not easy, because you need to put safety first.

- Eduardo Espinosa
Commercial Manager Andean Region,
Martin Engineering



”



Javier Castro

General Manager
MOLY-COP



What is the history of Moly-Cop in Peru?

The company was established in 1979 as Aceros del Sur. The first shareholders were Aceros Arequipa and COFIDE, who invited the Armco Steel Corporation to join the company. We were subsequently owned by other American corporations, GST and GSI, and by Scaw Metals, a subsidiary of Anglo American. In 2010, we were acquired by the OneSteel group, today known as Arrium, from Australia. In 2016, Moly-Cop operates plants in Peru, Chile, Mexico, USA, Canada, Indonesia and Australia. Moly-Cop is the leading supplier of grinding media globally and exports to the other mining regions where we do not have a manufacturing presence. In 1981, Moly-Cop Peru started operations in Arequipa, with a production line of 10,000 metric tons per year (mt/y), and today that plant has reached its top capacity of 60,000 mt/y. We have had a continuous relationship with five of our clients since the beginning, so, for 35 years. In 2002, we started operations in Lima, mainly to serve the Antamina operation. Initial capacity in Lima was 40,000 mt/y, this plant was upgraded in 2012 and today we can produce 115,000 mt/y.

How much capacity are you adding with your new plant in La Joya?

Our new facility in La Joya intends to meet the needs of the new projects, such as the expanded Cerro Verde, Las Bambas and Constancia. This new plant will have a capacity of 175,000 mt/y. Once we have the La Joya facility commissioned mid-2016, we will have a combined capacity of

350,000 mt/y in Peru. We believe this capacity will be sufficient for the medium to long-term. Additionally, I am sure we will have interesting opportunities for exports.

What are your main product lines?

Our main products are grinding balls of different diameters and we have a business line of chemicals for mineral flotation process. We also serve the smaller grinding rod market in Peru, but the market for this product is decreasing.

How have you adapted to the volume changes in the market?

20 years ago, the largest ball mills had maximum diameters of 16 feet and engines of 3,000 horsepower. Today, we have ball mills of 28-feet and 25,000-horsepower engines. Semi-Autogenous mills can reach 42-feet diameters and use engines of 30,000 horsepower. The impact conditions inside the mills are much higher today, so the product that was used 20 years ago would not have a good performance today. In SAG mills there is a trend to use larger balls, up to 6 inches in diameter. With regard to the quality of the steel, we are the only company in this business that has a dedicated R&D department. We have recently launched a new product, the NG SAG ball. It not only contains special alloys, but its fabrication process is also innovative. The grinding media business is very niche and we have a leadership position thanks to our technology and the performance of our product. Also, we have been constantly investing in our plants to improve our processes. In 1990, we set up our first grinding laboratory in Peru and

today it is the most modern laboratory for mineral processing tests in the country. Also, we have developed software for mineral processing, called Moly-Cop Tools, which is one of the best for this segment.

What is the size of the market for grinding balls in Peru?

The total market of grinding balls was about 180,000 metric tons per year in 2010, and today it has grown to 300,000 mt/y. We work with the largest mines in the country, like Antamina, Cerro Verde, Toromocho, Las Bambas, Antapaccay, Constancia, Yanacocha, Gold Fields, Southern Copper and some medium-sized mines as well. The main competitor locally is Mepsa. Over the last 20 years we have seen other players coming in and out of this market with imported products, but never with a permanent presence in Peru.

What has been the impact of Moly-Cop in terms of creating employment and adding value to the economy?

I firmly believe that mining has been the engine of the economy over the last years. It represents close to 50% of all the exports of the country. Mining companies need all sort of highly-skilled contractors and value-added supplies. Years ago, all the equipment arrived in Peru totally assembled; today, there is much more local content in the equipment the mining industry uses. Mining has also promoted decentralization, and has helped improve education standards. Our project in La Joya, 50 km from Arequipa, will start the development of a new town and could trigger a new industrial area in southern Peru. —

◀ 101

partment. To respond to the increased demand in the country (the market for grinding balls has jumped from 180,000 mt/y in 2010 to 300,000 mt/y today), Moly-Cop is investing in a new 175,000 mt/y plant in La Joya, near Arequipa, to reach a total capacity in Peru of 350,000 mt/y. This will cover any demand increases over the next years, and also opens up export opportunities.

Another enhancer of plant performance that offers a wider range of technologies is Thyssenkrupp Industrial Solutions, a company that has identified a great niche in the provision of its high-pressure grinding rolls (HPGRs). After its expansion, Cerro Verde now has 12 HPGRs running, and it is already benefitting from its lower energy consumption levels, as compared to SAG mills. Besides the HPGRs, Thyssenkrupp is confident in the increasing adoption of overland conveyor technologies, which may require larger initial capital investments, but which offer cost advantages during the life of the mine.

Conveyor belts are key components of mineral processing, as maintenance stops affect the whole operation. Martin Engineering, an international provider of plant solutions including dust suppression products and flow aid equipment, is working to optimize the belts' maintenance stops, according to Eduardo Espinosa, its commercial manager for the Andean region: "We constantly look at how to reduce to the minimum the maintenance

stops for the belts. We provide cleaning solutions that can be used even while the belt is working. This is not easy, because you need to put safety first."

"With regard to the air cannons, they are designed to be highly energy-efficient, but at the same time we are designing some accessories that facilitate the inspection of the equipment without having to enter the pre-heater, and without having to stop the plant. This way you increase safety and productivity," said Espinosa. Life-cycle productivity is at the core of mining operators today, as they are handling short-term budgets for specific debottlenecking projects. Miki Villar, sales and marketing manager for Outotec in the Andean region, does not expect a new wave of investments before 2018. He says that, with optimization processes, it is increasingly likely that the technology provider will end up working directly with the mining client, rather than with an EPCM provider: "Mining companies are increasingly dividing their projects into separate niches and go to the market to find the most cost-effective solution for each of them. The provider that wins the project is in charge of integrating everything in that particular box," he said.

Project optimization also involves a bigger role of Outotec's automation solutions, where remote monitoring services are increasingly important for the company in Peru. —

A NEW DAWN IN LA JOYA



Moly-Cop Peru's Modern Grinding Media facility in Arequipa, to continue to support our customers in securing their future high quality Grinding Media requirements locally.

Moly-Cop Peru, part of the Global leading suppliers of Grinding Media - Moly-Cop



www.molycop.com

Mijail 'Miki' Villar

Sales and Marketing Manager
OUTOTEC



What is the history of Outotec?

Outotec comes from Outokumpu, which was initially a copper mining company in Finland. In 1950, the technology arm of Outokumpu launched the flash smelter for copper operations. Today, Outokumpu is a stainless steel specialist, while Outotec has made its path as a technology firm. Over time, we merged with other organizations, like Lurgi Metallurgie and Larox. We have two main business areas: mineral processing on one side, and metals, energy and water on the other. Mineral processing is our main activity in Peru due to the nature of the industry here where there are big extractive operations. There are only a handful of refineries; in Cajamarquilla, Ilo and Funsur. We are present in grinding, flotation, thickening and other processes. We also offer automation solutions with on-line analysis.

Do you work with EPCM contractors or directly with mining companies?

Typically, processing plants send their requests to project integrators like engineering companies, and we act as technology providers for

these project managers. Having said this, mining companies are increasingly dividing their projects into separate niches and go to the market to find the most cost-effective solution for each of them. The provider that wins the project is in charge of integrating everything in that particular 'box'.

How important is innovation for a company like Outotec?

Having been born as the technology arm of a mining company, we have developed a different focus that puts innovation at the center of our work. Back in the 1950s, the flash smelter was a game changer for the metallurgical industry. Over the years, we have identified areas of operation that did not have the appropriate technology, and we have developed such technological solutions. Moving forward, we see great opportunities in energy and water management.

Could you give us a recent example of innovation in Peru?

In Peru, there is a quechua word, *pallaqueo*, that defines an activity that was done manually. It consisted of the manual inspection of the rock to identify the high-grade material that would go through the plant, and separate the waste. Today, with low mineral prices, high energy costs and restrictive environmental laws, pallaqueo is being done again. For that, we are introducing an innovative device, a sorter that does the same job automatically. It is manufactured by a third company that used to apply this methodology in the food industry. In terms of automation solutions, we are firmly entering the business of remote services, so we can monitor the performance of the different plant items from the office and plan maintenance adequately.

Automation and Energy Efficiency

The adoption of new technologies still has a long way to go in these areas

Processing plants offer opportunities to include new automation technologies. According to some estimates, only between 0.5 and 2% of the capital expenditure of a mining project goes to automation, yet the impact it has on productivity is enormous. Multi-national company Siemens is working to introduce new automation solutions to the market, trying to utilize the potential of the digital world to its full. According to Edwin Chávez, CEO of Siemens Peru, Ecuador and Bolivia: "Automation needs to meet two goals: to improve the quality of the processes, and to acquire data that will allow the client to further improve those processes and reduce costs."

Chávez affirmed that, in the mining industry, automation can play a key role in providing energy savings, while other parameters, such as temperature and pressure, can also be optimized to increase productivity in the processing plant. "This allows the operator to take the best decisions before it is too late. Without automation, you would need to reach the end of the process to introduce changes at much higher costs." In terms of energy, the company covers the whole range from generation to distribution. Looking at its industrial solutions, besides serving the large thermal and windpower generators in the country, Siemens is increasingly focusing on mining and industrial clients that have smaller power generation needs, according to Juan Carlos Castañeda, energy service country lead at Siemens. Another global player with a focus on energy management is Eaton. Having worked with distributors for over 25 years, the company is strengthening its direct presence and is going to invest in a service center in Arequipa focused on the mining industry, which currently provides 80% of the company's revenue in the country. "Our advantage in the electrical distribution business is that all processes in mining require energy," emphasized Franco Bulnes, country manager at Eaton.

Rise of the machines?

Labor costs are rising in Latin America, making the case for more automation, but Edwin Chávez said that Siemens' vision is not to have plants solely operated by robots. "Our idea is to have automation systems, but also human talent intervening where it is more valuable: not in the manual part, but in the analysis of data," he said. Rodrigo Prialé, CEO of Gerens and president of the 3rd International Mine Management Congress in Lima, added: "Peru still offers very competitive costs as compared to other mining countries, so perhaps the adoption of automation technologies will not happen so fast as in other countries." Rapid technological development, though, is actually pushing change. Juan Parra, commercial manager of Emerson Process Management, pointed out the transformational role of wireless technologies and smartphones: "There will be a revolution in the instrumentation market similar to what the cell phone meant to the telecommunications market. Only 5-6 years ago, you would only use a cell phone to talk and text. Wireless technologies are the future."



**Mining & Investment
LATIN AMERICA SUMMIT**
24th & 25th, October 2016 The Westin, Lima



The only event for mining investment and efficiency strategies in Latin America

Speakers



Daniel Meilán
Mining Secretary
Ministry of Energy and Mines,
Republic of Argentina



Frank Holmes
Chief Executive Officer and
Chief Investment Officer,
US Global Investors



Javier Cordova Unda
Minister,
Ministry of Mining, Ecuador



Roque Benavides,
Chief Executive Officer,
Buenaventura Corporation
(IFC)



Martin Valdes
Head of Latin America,
Resource Capital Funds



Keith Spence
President,
Global Mining Capital



400
Over attendees



53
Speakers



60%
Government Officials,
Miners & Investors

Save 20% by using the promotional code: **GBR20**
Register your place at: www.MiningLatam.com or
Contact: Jessica.Wheater@GFCMediaGroup.com



**Eaton y Cooper Unidos
Energizando un mundo que pide más**

Brindamos:

Soluciones eléctricas que usan menos energía, mejoran la fiabilidad de la energía y hacen de los lugares donde vivimos y trabajamos más seguros y más cómodos.

Soluciones hidráulicas y Eléctricas que permiten a las máquinas entregar más productividad sin desperdiciar energía.

Soluciones Aeroespaciales que hacen la aeronave más ligera, segura y menos costosa de operar, y ayuda a los aeropuertos a operar con más eficiencia.

Soluciones de trenes impulsores y trenes de potencia del vehículo que entregan más potencia a camiones, buses y automóviles, mientras reducen el consumo de combustibles y emisiones.

Descubre el Eaton de Hoy

Proyectos - Ensamblajes



Equipos Eléctricos



Distribución, Control y Automatización



Respaldo de Energía



Servicios



EATON
Powering Business Worldwide

Ax. José Pardo 513, Oficina 1003 - Miraflores, Lima PERÚ - Teléfono: +511-611 2706
www.eaton.cl - Para mayor información contáctenos en customerserviceperu@eaton.com

Edwin Chávez

CEO Peru, Ecuador and Bolivia
SIEMENS



What are Siemens' main business lines?

Siemens is a global company with operations in 190 countries and a history of 162 years. The main pillars of Siemens are electrification, automation and digitalization. In electrification we cover power generation, transmission and distribution. In automation we take care of all the automation processes in many industrial segments, such as mining, manufacturing, pharmaceuticals and food and beverage. Digitalization is the newest segment for Siemens: it is dedicated to the utilization of the data that comes from all the automation processes. Today, the trend is to handle everything digitally. We can use all the data available to continue improving processes and achieving more efficiency. The digital world is being underused, so we want to use it to its full potential.

How do your technologies apply to the mining industry?

All three pillars are relevant across the mining value chain. Our technologies allow the energy to reach all the critical points of the process, with quality and reliability. One of the traditional mining areas where we are very active is in the gearless drives, the large mills that are used in the comminution process. Most of the other systems we provide can be used in mining as well as in many other segments, because any industry requires automation and energy supply.

In Peru, are you mainly a technology provider or also a service provider?

In different countries we have a different presence. In Peru we do not have maintenance contracts, because here mining operators are not so favorable to outsource industrial maintenance to third parties. As the market becomes more mature, we should see a trend to imitate the Chilean model. In Chile, on top of all the technologies and systems that we offer, we have several full maintenance contracts where we work under certain parameters and key performance indicators to help the client maximize mineral production. This includes preventive maintenance stops.

The market penetration of automation technologies is quite low in Latin America. What opportunities do you see to grow in this business?

There is a huge space for growth in automation in Latin America. When you go to Europe, the United States or Japan, you see

complex automation systems everywhere, from the moment you arrive in an airport. In Latin America, the most advanced countries in automation are the largest ones, such as Brazil, Mexico, Argentina and to a lesser extent Colombia and Chile. In the rest of the countries, everything is still to be done. With the increasing availability of cheaper and user-friendlier electronics, we will see more automation.

Automation needs to meet two goals: to improve the quality of the processes, and to acquire data that will allow the client to further improve those processes and reduce costs. In Europe, the big driver for automation has been the high cost of labor. In Latin America, labor costs are not so high, hence the delay in the investment in new automation systems. This is changing, as labor legislation is becoming more stringent. However, there should be a balance between automation and the role of humans: we cannot conceive a factory where everything is done by robots. Our idea is to have automation systems, but also human talent intervening where it is more valuable: not in the manual part, but in the analysis of data.

In the mining industry, automation can play a key role providing energy savings. Energy is one of the key cost drivers for mining operations. Other parameters, like temperature and pressure, can also be optimized along the mineral process, using automation. We have all sorts of instruments to capture all the relevant information that will allow the operator to take the best decisions before it is too late. Without automation, you would need to reach the end of the process to introduce changes, at much higher costs.

What are the prospects for Siemens in Peru?

Peru is very attractive for international investors due to its competitive energy and labor costs. Promoting a business-friendly environment is key because all the countries in the region want to develop their mining industries. At a company level, there is a growing focus on *opex*-related projects in the mining sector. This year the big chunk of our revenue will come from energy and transportation projects. Over the last years we have been a key player in thermal gas and wind power developments, while we have also provided the electrification of the two Metro lines, one of them under construction. —

Franco Bulnes

Country Manager
EATON



What are Eaton's main lines of business and international presence?

Eaton Corporation is a company focused on energy management, with a vision to provide safe, efficient and sustainable operations. We currently are present in over 100 countries. Eaton's main business is in the electrical segment, but it is also present in the industrial segment with mechanical and hydraulic components; in the automotive business; and finally, in the aerospace industry as well. The company was created in 1911, and has been growing organically and inorganically: over the last 11 years it has acquired over 50 companies. We now have sales of around \$25 billion worldwide and more than 100,000 employees.

Through acquisitions we have acquired many different brands, so Eaton is associated to many different names. We recently acquired a company called Cooper, which was very well known in the extractive industries. Our global strategy is to constantly look at diversification to complement our product portfolio in energy management.

In Peru we have had a direct presence for three years, although we have been working with distributors for 25 years. We are going to invest in a new service center in Arequipa focused on the mining sector, because in recent years we have significantly increased our installed capacity in the different projects in southern Peru. We have a lot of low and medium voltage equipment in Cerro Verde, for instance. We are also present in Southern Copper, Las Bambas, Antapaccay and Shougang, as well as operations in the other regions of the country, such as Volcan, Milpo, Yanacocha, Barrick and Antamina.

How does Eaton Corporation perceive Peru in terms of its growth potential?

Peru is the market in the region where Eaton has invested more, proportionately. We are still a small operation but we have grown by 50% over the last couple of years. Locally, 80% of our revenue comes from mining and our aim is to diversify to other markets as well, including infrastructure and data centers.

In which areas of the mining projects do you participate?

Our advantage in the electrical distribution business is that all processes in mining require energy. As part of that, we provide all the tools for electrical distribution, in low and medium voltage and all the switches and actuators that go with it. We also have transform-

ers, frequency speed drives for the conveyor belts, engine control centers for pumps, voltage regulation systems, illumination systems, protection systems, measurement systems, monitoring software, backup systems, electrical SCADAs and others.

What sorts of service do companies require once the project is in operation?

It is important to keep up with all the installed capacity, not just of the Eaton systems, but also all the brands that we have acquired over the years, like Cooper, Westinghouse and many others. In that respect, we have clients that ask us for maintenance and overhauls. The needs change depending on the industry cycles; before, the clients had a lot of money to buy more equipment, they would even acquire two or three backup systems, but today this is not the case. If the equipment had to last 10 years, today it needs to work for 20 years. Our local partners also offer after-sales services, but we can offer some advantages to our clients if they work directly with us, such as longer warranties.

What is Eaton's brand identity in the market?

Over the last years, Eaton has experienced strong growth in terms of its presence in the mining operations. This has helped us a lot for brand recognition, and we are high on the operators' vendors' list. Also, the generations have changed; managers from the old school associate Eaton to Westinghouse, which was a very well-known brand in the 1980s. The new generations, though, recognize Eaton very well. Mine managers do not want to be the first to try a new technology, they like to use proven technologies that have the relevant norms and certifications. In that respect, Eaton has a great reputation in the market thanks to its extensive presence in North America and the level of inspections and certifications it complies with.

How can you improve your tools and systems through research and innovation?

Eaton invests a lot in R&D. The main focus right now is on digitalization and software development to control the electrical systems. We believe that the future of energy management is in the area of software and automation and in the levels of data that you can compile to make the operation more secure and efficient. Improved technology also means that systems are cheaper, more compact and easier to use and maintain. —

Juan Parra

Commercial Manager
EMERSON PROCESS MANAGEMENT



“

Wireless technologies are the future; they will be a revolution in the instrumentation market similar to what the cell phone meant to the telecommunications market. Only 5-6 years ago, you would only use a cell phone to talk and text.

”

What is Emerson Process Management's main specialty?

Emerson has always been a technology leader in automation, not only in the mining industry but in other segments as well, such as energy and oil refining. Besides all the support that we can provide to optimize processes, the great challenge of Big Mining lies in operational excellence. We have seen expansions, such as the one in Cerro Verde, where just by increasing volumes you automatically reduce costs per metric ton. The challenge there is to keep the plant running all the time. The idea is to implement preventive maintenance strategies in order to minimize plant stops. Automation is also a key factor to increase safety: for instance, wireless technologies allow for measurements in areas that are not accessible for operators, avoiding risky situations.

To what extent can you incorporate wireless technologies?

Wireless technologies are the future; they will be a revolution in the instrumentation market similar to what the cell phone meant to the telecommunications market. Only 5-6 years ago, you would only use a cell phone to talk and text. The new paradigm in big industries, in particular in the mining industry, is to be in the top quartile of operators that move towards operational excellence.

How can you help mining companies already in production be more efficient?

Emerson acquired a company called MRG, which is dedicated to auditing the clients' processes in operations and services. We can identify the gaps they may have and provide advisory on the world's best practices based on our technology platforms. Cerro Verde commissioned its expansion two months before schedule thanks to their optimization of processes and the support of our technologies. In Peru, we also work with Pluspetrol and Southern; we have recently started an assessment process with Southern through MRG to identify areas of improvement at the Ilo smelter. In companies that already have great processes, it is a fantastic challenge to keep improving. A company like Pluspetrol has an availability level of 98%. The only 2% missing corresponds to six days a year where they need to stop the plant.

R&D plays a key role. What are Emerson's most recent developments for mining?

Emerson decided to set up a center of excellence for mining in Santiago, Chile. We won a contest and we receive \$10 million per year from the Chilean government to develop new technologies. We are now working at the Zaldívar mine on intelligent heap leach pads using wireless technology; we are also working on the optimization of hydrocyclons at Antofagasta Minerals. Another area of focus is flotation cells.

The traditional mining engineers, especially in Peru, do not want to be the first to try new things, but sometimes we have some visionary clients that let us test our new applications. One example is our solution for temperature monitoring in SAG mills, which was first tested at Yanacocha. A variation in temperature can show a problem in the lubrication system, so we installed wireless technologies for temperature measurement. This was so successful that ABB, one of the main manufacturers of these SAG mills, has incorporated this feature in their designs.

What has changed in the old Vamsac team since Emerson took over the operation in Peru?

One of the advantages we have today, as Emerson, is that there is a strict requirement for all our workers to have high levels of training. With the new organization, we are able to do all the plant visits to identify new opportunities. As Emerson we have 11 business units, so we try to understand our clients' processes in order to offer all our different technologies that may be useful for them. Some competitors have just one product or one technology and they have to sell it, no matter the situation.

How do you think miners should look at automation solutions?

Mining investments are very big, but the large portion of the money goes to the large pieces of equipment. In a project like the expansion of Cerro Verde, for instance, the automation solution only represents 0.5% of the *capex*, however the impact of automation can define its success or its failure. Also, the culture in mining companies needs to change in order to implement successful preventive maintenance strategies. Today, if you have a team that successfully avoids a one-day stop thanks to these initiatives, companies do not have any bonuses or incentives in place to reward them. As part of our 'discovery' efforts when we do plant visits, we also talk to the human resources department to work in that direction. —

PARTICIPE

DO MAIS IMPORTANTE EVENTO MUNDIAL DE MINERAÇÃO!

Join the world's most important event of mining!



24th World Mining Congress

MINING IN A WORLD OF INNOVATION

MINERAÇÃO NO MUNDO EM INOVAÇÃO

Conheça as cotas de patrocínio, merchandising e estandes disponíveis para sua empresa!

Faça contato: wmc2016@pandapromo.com.br
+55 (31) 2108.2121

Get to know about sponsorship fees, merchandising and booths available for your company!

Contact us: wmc2016@pandapromo.com.br
+55 (31) 2108.2121



18 a 21 de outubro de 2016 | October 18 - 21, 2016

Rio de Janeiro/RJ | Rio de Janeiro (RJ)

Aumente a visibilidade de sua empresa associando sua marca ao World Mining Congress 2016.

Increase the visibility of your company by associating your brand to the World Mining Congress 2016.

Inscrições e informações/For further information, please visit:
www.wmc2016.org.br

DIAMOND SPONSOR		GOLD SPONSOR		SILVER SPONSOR	BRONZE SPONSOR	SPECIAL SPONSOR
					 	 
STEEL SPONSOR		SPECIAL SUPPORT		PROMOTION		EXECUTIVE PRODUCER AND MARKETING
				 Ministério da Ciência, Tecnologia, Inovações e Comunicações		 INSTITUTO BRASILEIRO DE MINERAÇÃO Brazilian Mining Association Câmara Mineira do Brasil
COMMERCIAL PARTNER (INDIA)		COMMERCIAL PARTNER (CANADA/USA)		OPERATIONS MANAGEMENT		
				 COMUNICAÇÃO CORPORATIVA		 ARQUITETURA E EVENTOS  EVENTOS
INSTITUTIONAL SUPPORT						 PROMOÇÕES E EVENTOS
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						
						

Apoios confirmados até agosto de 2016

Institutional Support confirmed until august, 2016



CREATING LONG TERM
RELATIONSHIPS WITH
OUR CUSTOMERS

CHEMICALS FOR THE MINING INDUSTRY

- Sodium cyanide
- Sulfate Copper / Zinc
- Hydrogen Peroxide
- Sodium Metabisulfite
- Nash
- Defoamers / Foaming
- Flocculants / Coagulants
- Antiscalants / Corrosion Inhibitors

ENVIRONMENTAL PROGRAMS

We provide solutions based on Advanced Oxidative Processes

- Cyanide Destruction
- Acid Water Treatment
- Industrial and Domestic Effluent Treatment
- Gas Washing / Cleaning

WATER TREATMENT PROCESSES

- Boilers
- Cooling Towers
- Flotation Circuits Solutions
- Metal Leaching

Dean Valdivia 148 Of. 601 San isidro, Lima - Perú
Phone: (511) 630 6500 / Fax: (511) 630 6501
www.quimtiamedioambiente.com
www.quimtia.com

Productivity and Environmental Solutions

*Products and technologies for
better performance*

With commodity price volatility and increasing levels of awareness and regulation about the environment, mining operators need to maximize production while reducing their environmental impacts and exposure. A number of solutions and technology suppliers can lend a hand in achieving this objective.

Quimtia, a supplier of chemicals, saw its business of commodity chemicals grow significantly in the past thanks to high gold prices and the provision of cyanide; yet, today the focus is on specialty chemicals for mineral processing and environmental solutions. These are sold in smaller quantities, but add more value and allow for a closer relationship with the client. "Peru's mining industry will base its growth on copper development. Moving forwards, we want to increase our business in flotation processes, with products such as foaming agents and collectors that can improve copper recoveries," said Eduardo Galdo, sales manager for mining at Quimtia.

Galdo maintains that Quimtia is constantly looking for new chemicals that can improve metallurgical processes. "If a thickener for concentrates can reduce the use of water, clients are already saving money. We have cheaper and more efficient alternative solutions to MIBC, which is a standard foaming agent used in flotation," he added.

The company also has a strong business in water treatment. Indeed, water and tailings management are a key issue for mine managers. According to Christopher Howell, vice-president mining and metals for Veolia, a French group, there is a trend to-

wards finding alternative ways of handling tailings: "If you cannot increase your footprint, you may want to remove the tailings from the storage facility to make space for new tailings."

Howell elaborated on this: "We are doing a pilot project in Brazil looking at a rapid, relatively mobile or modular dewatering technology. We are looking at how to team with companies like FLSmidth in order to polish the water portion of tailings management, and to how Veolia can provide a process flowsheet as a service instead of a high capital cost item, providing a dollars-per-cubic-meter solution."

Another company focused on water treatment and dewatering technologies is Xylem, best known in Peru's mining sector for its wide range of pumps. The company is trying to change its business model: "Before, the client needed water and we would pump it over to him. Now, we can bring the water, but also we can treat it and help the client control it," explained Carlos Coll, sales manager at Xylem.

The company implemented an automation project in Cerro Verde to operate pumps remotely, reducing the hassle and risks of constantly sending operators down the pit. Coll added that they are taking this technology to an underground mine this year: "Currently, our client needs 50 to 100 people to go around the tunnels and check the pumps, take measurements and turn them on or off. With a remote monitoring room, you would need a maximum of 10 people. This would improve productivity and safety because less people would be exposed to the risks of underground mining." —

Eduardo Galdo

Sales Manager Mining
QUIMTIA

As a chemicals provider, how has your mining business evolved over the last years?

When Quimtia was created to unite the different chemical business of the Fierro Group, we wanted to have more efficient sales processes and be closer to our clients. In the particular case of mining, we unified our different business lines (commodity chemicals, environmental and specialty chemicals). The idea was that our sales people could spend more time with the clients, to better understand their needs and challenges. In parallel to this process, we set up a research and development department that actually dedicates 70% of its efforts to mining, even if we are present in several other industries. We see mining as a strategic sector with lots of potential. In 2011-2012, we experienced a boom in cyanide sales due to the high prices of gold and silver, which pushed cyanide prices up. Today, metals prices are lower, and that has impacted our sales of basic chemicals. Over the last four years, we have been trying to diversify away from commodity chemicals and to give more emphasis to specialty chemicals for mineral processing, as well as to chemicals for environmental management.

What are the main growth drivers for Quimtia in mining?

We represent different brands, including Nalco, that are well-known worldwide in everything related to water treatment. Combining their global expertise with our local knowledge, we can provide different products in water treatment, like anti-fouling products, corrosion inhibitors, biocides, and even the equipment required for water treatment processes, such as reverse

osmosis systems, filtration systems and cooling towers. In anti-fouling products and corrosion inhibitors we have a market share of around 70%. The same applies for cooling towers. Overall, we are very strong in water treatment.

Also, we are strong in environmental products. In the case of Peru, which has a big gold and silver mining industry, you need to destroy the cyanide after the mineral process. In this area we can offer all the solutions for advanced oxidation made with hydrogen peroxide, which we source from Peróxidos do Brasil. Also, mining companies need to treat the underground water they find as they mine, and the water from tailings in order to re-use in the mining cycle.

Besides this, we are targeting the solid-liquid separation business as an important area for us, with flocculants and coagulants. Peru's mining industry will base its growth on copper development, while in the past the products for precious metals operations, like cyanide and hydrogen peroxide, represented most of our sales. Moving forwards, we want to increase our business in flotation processes, with products such as foaming agents and collectors that can improve copper recoveries.

How can chemicals increase efficiency?

The fall of the copper price, coupled with the large investment projects that companies have undertaken over the last years, has created some issues in terms of cash flow for mining operators. In that respect, we understand that we need to offer better pricing for our clients but, more importantly, we are constantly looking for new chemicals that can improve their processes. For instance, if a thickener for concen-

trates can reduce the use of water, they are already saving money. We have cheaper and more efficient alternative solutions to MIBC, which is a standard foaming agent used in flotation.

Who are your main mining clients in Peru, and how important is mining for Quimtia?

We work with all the main mining operators, including Buenaventura, Yanacocha, Cerro Verde, Chinalco, Las Bambas, Southern Copper and Antamina. As we try to have more sales representatives per region, we are also focusing on medium-sized mines, where we were not so present before. Our aim is to see at least one product from Quimtia in all of the country's mines, from small mines to large ones. Quimtia Peru had sales of \$130 million last year, out of which \$42 million came from the mining industry. Regionally, putting together Peru, Brazil, Colombia and Argentina, we have sales of around \$300 million. Peru is the only country in the region where we serve the mining industry.

What are your goals for the next year?

One of our main objectives is to renew our product portfolio, as part of our research and development effort. We need to enter new areas of business where we are not present and identify future needs that will become a relevant business. As a result of this, we will be increasingly active in specialty chemicals for mineral processing, and will rely less on the sales of cyanide and hydrogen peroxide. Finally, we want to strengthen the relationship of our collaborators with the different mining companies, to have a closer link with our customers. —



Christopher Howell

Vice President Mining & Metals
VEOLIA



What are Veolia's core business segments?

Veolia was started by Napoleon's grandson over 160 years ago. Today, it has about 180,000 employees globally with a turnover of around \$30 billion. We are the largest water treatment company worldwide, probably double or triple the size of our nearest competitor. We have three main pillars of offering: water, waste services and energy. Water breaks down into municipal versus industrial, and into technologies versus operation and maintenance services. Waste services include waste management, for hazardous and non-hazardous waste; and very diverse services from trash collection to the disposal of the chemical weapons from Syria. In energy, we are one of the largest independent local power producers in Europe. We do not build power plants per se, we operate them or we operate energy infrastructure, making sure when possible to switch from fossil fuels to renewables be it wood, straw or even olive pits. At the other end, we offer services as simple as achieving energy efficiencies in commercial settings.

What potential do you see in the industrial sector, and more specifically in mining?

Historically, the majority of revenues have come from the municipal sector, in long-term water concessions in large cities. In some cases, it may take 20 years into a 40-year contract to pay off the investments in infrastructure. It is a challenge we do not see in the industrial sector. While we were predominantly a 80%-municipal, 20%-industrial company, we want to have a 50-50

split in the medium term, without decreasing our municipal business. In Peru, municipal revenue is probably about 80% of the total, so we want to focus on the industrial segment.

Within industry, five markets make up nearly 80% of our revenues: oil and gas, mining and metals, power, food and beverage and pharmaceuticals and cosmetics. Traditionally, oil and gas has been the leading segment, while mining and metals has been the fastest-growing segment over the last years.

What can Veolia offer to mining companies?

In mining, the earlier we get involved, the better. We have the DNA of an engineering company combined with the operations, which makes us relatively unique. We can offer services throughout the entire evolution of the project, from the opening of a mine to its closure and the restoration of the natural habitat. In exploration we can evaluate the water resources and environmental impacts. In environmental services we can have smaller water systems for an exploration camp, all the way to a very large desalination system for a large mine, and everything in between.

Mining companies are looking for the lowest possible costs, while simultaneously reducing the energy required to extract ore and maintaining their operating licenses, which is easier said than done. One of the key factors is the impact of water on the environment; some mines have a positive water balance and need to discharge waste, typically converting it into solid waste that is easier to manage. Within Latin America,

we are working for Codelco at El Teniente, where we take soluble copper out of the tailings facilities, process it and provide the concentrate back to Codelco.

After the Samarco disaster, how are mining companies changing the way they handle tailings?

There is definitely a trend towards finding alternative ways of handling tailings. If you cannot increase your footprint, you may want to remove the tailings from the storage facility to make space for new tailings. We are doing a pilot project in Brazil looking at a rapid, relatively mobile or modular dewatering technology. We are looking at how to team with companies like FLSmidth in order to polish the water portion of tailings management, and to how Veolia can provide process flowsheet as a service instead of a high capital cost item, providing a dollars-per-cubic-meter solution.

How does the mining industry perceive Veolia?

The biggest complaint we get is 'Veolia is too big and I do not know who to talk to'. We can do very well in projects below \$1 million or over \$100 million. We do not want to be seen as a big ticket company. Several years ago, GWI published a report called 'Water for Mining', which stated that we are the world's largest provider of water services to the mining industry globally. The good news somehow is that our market share is only 10%, and probably just 1% in Latin America, so there is plenty of space to grow. We want to increase our mining and metals market share by 10% every year. —

Carlos Coll

Sales Manager
XYLEM



What is the importance of Peru for Xylem worldwide?

Xylem Inc. is active in more than 150 countries. Peru represents 10% of all the revenue for Latin America, and we expect that figure to reach 13% this year. Internationally, and especially in Latin America, Xylem's presence is very strong in government-owned water and sanitation companies, because of our great solutions for drinking and residual water treatment. However, in Peru 80% of our revenue comes from the mining sector, mainly from dewatering solutions. We are present in all the large open-pit mines and in many underground mines, but we still need to increase our presence in junior mining companies.

What is your strategy moving forwards?

Since 2014, we are trying to diversify. We have a very wide range of products where we see excellent opportunities in Peru. We now have a bigger participation in the construction business, either in big infrastructure projects (hydropower plants, pipelines, irrigation projects) or real estate developments, including malls and residential projects. We are also entering the agriculture and fishing businesses. We are promoting the use of new technologies for water treatment, which are a bit more expensive initially but have very low operational costs. We promote the use of ozone and ultra-violet cleaning systems, which are healthier and easier to maintain than chlorine systems.

Besides, we are also offering service contracts, where we not only sell the pumps but also provide the maintenance and make sure the client has low operational costs. Our goal is to change the business model. Before, the client needed water and we would pump it over to him. Now, we can bring the water, but also we can treat it and help the client control it. As an example, we had an automation project in Cerro Verde, where we successfully operated the pumps remotely. Now, responding to a client's request, we are developing a similar solution in an underground mine. Today, our client needs 50 to 100 people to go around the tunnels and check the pumps, take measurements and turn them on or off. With a remote monitoring room, you

would need a maximum of 10 people. This would improve productivity and safety because less people would be exposed to the risks of underground mining.

What sort of technologies are you thinking of to increasingly work with juniors?

We have portable water treatment systems that we can sell or rent to exploration companies. Right now, the companies that build the camps bring the water from outside, using water tanks. However, if you have a water source nearby, you can treat it with our system; the same applies to residual water. There is no need to bring large quantities of water in and out.

You have many brands and products. How can you provide the best solution to each client?

In Xylem, every sale is a tailored suit. Every client has a different water need. In extraction, transportation and treatment, there are several solutions for the same need. Our sales force knows the products very well and can provide the optimal solution. We also have a team of engineers in-house; in case of more complex projects, we have the support of our international offices in Sweden and Argentina. Our flagship brands are Flygt, for submersible pumps; Godwin for motor pumps; and Goulds for well pumps. These brands are already very well positioned in the market, and where we are trying to increase our presence is in the water treatment items, with the Leopold filters and the Wedeco ozone and ultra violet systems.

Water plays a key role in the relationship between mining companies and local governments and communities. What is Xylem's position in this equation?

We work together with mining companies to include educational presentations for the communities and teach them how to save water and make a better use of it. We are also implementing our own social responsibility initiatives. As Xylem we have an NGO, Watermark, that we are going to promote more actively this year in Peru, on top of our joint work with mining operators. —



MINING SERVICES



“Due to the lower metal prices, mining companies have undertaken very aggressive policies to reduce costs. In many cases, we see that the purchasing processes are strongly influenced by logistics managers rather than technical managers. The challenge, in this context, is to ensure that quality is not affected”.

- Miguel Caillaux,
Director,
Certimin



AK Drilling International

We love what we do...
and we know how to do it!

- Reverse Circulation Drilling
- Diamond Drilling
- Water Well Drilling
- Horizontal Drilling
- Geotechnical Drilling
- Flooded Reverse Circulation Drilling
- Conventional Air Rotary Drilling
- Construction Drilling
- Submersible Pump Sales and Service



AK Drilling International S.A.
Calle Perseo Mz. J Lote 12 Urb. La Campiña,
Chorrillos - Lima 9 - Perú
Tel: (511) 2513380 | Fax: (511) 2511472
E-mail: info@akdint.com www.akdrillinginternational.com

Global Business Reports

Drilling Contractors

Big shoulders required

The exploration segment is where it all starts, and it has been the first victim of the low cycle. While operating mines have continued a good portion of their brownfield exploration efforts, generative exploration has been pretty much wiped out of the market. Geotec, a drilling contractor, only had 15 rigs operating earlier this year, out of a fleet of over 60. Its general manager, Miguel Ángel Arenas, looked at the positive side of the crisis: "We were able to offer a better rate to the market thanks to achieving more efficient processes. Our advantage in low periods is that, along with selecting the best equipment, we have also kept the best supervisors, drillers and technicians."

60% of Peru's drilling market corresponds to underground exploration, an area where Geotec intends to enter soon. "We are losing out by not being present in underground mining," said Arenas.

AK Drilling is another company focused on the surface mining segment, although it is present in underground operations in Chile. In Peru, the company has 25 rigs. Jorge Granda, its general manager, lamented the companies' move to cut exploration: "The mining industry is very emotional and reactive. When prices are down, no one does anything, when it should be the exact opposite: it is the moment to explore and buy properties, because everything is cheap."

Granda developed on how technology is changing in the drilling business: "There is a trend for more digitalization and the use of parameters, to have a combination between the driller and the additional tools technology can offer. Every hole requires a different analysis."

Big mining companies are looking for established contractors that can invest heavily in training and new technologies. Small drilling players are increasingly out of the market, as they cannot afford to comply with the clients' strict technology requirements, their safety induction periods lasting up to 25 days, and payment policies where sometimes the contractor does not see a dollar until 100 or 120 days into the job.

The introduction of new technologies is partly promoted by the very high safety standards of the global mining operators. "Today, safety is the most important thing for the client. Only after that, they start measuring your productivity and performance," said Noé Vilcas, general manager of Explomin, another drilling contractor. As part of this process, Explomin has recently acquired five rod feeders, as well as two rod handlers for reverse circulation rigs. —

Global Business Reports

Global Business Reports

Jorge Granda

General Manager
AK DRILLING INTERNATIONAL



How is AK Drilling adapting to the downturn in exploration?

AK Drilling is based in Lima and it currently operates in five countries in South America where we have captured important market niches. This has allowed us to diversify the risk during the crisis and to create synergies within the organization. We have restructured to be ready for the next hike in commodity prices. For instance, we have specialized in all the different drilling activities at a corporate level. In Peru we only work in surface mining but we have underground activities in Chile, for instance. In Peru, we currently offer diamond drilling, reverse circulation drilling, water well drilling, geotechnical drilling and horizontal drilling for dewatering. Our main industry is mining, but we also work in the construction segment, and we are entering the oil and gas business in Colombia. At a corporate level, we are working at 70% of our capacity.

Specifically in exploration, how has the market changed?

Right now, the market is probably 90% producers and 10% juniors. The junior market has contracted a lot, however, I am sure that the activity is going to come back soon. While commodity prices are an important factor, I think that in Peru the political environment and the bureaucratic barriers also play an important role. If the country solves this issue, the market is going to improve, notwithstanding commodity prices.

The mining industry is very emotional and reactive. When prices are down, no one does anything, when it should be the exact opposite: it is the moment to explore and buy properties, because everything is

cheap. However, there is another factor: social conflicts. Some companies prefer to start exploration down deep and move upwards, to avoid the conflicts at surface. At surface you have the issue of archeological remains, and now you even need to declare any fossil find. However, the underground drilling market uses old equipment and lacks innovation.

With miners pushing for lower prices from contractors, what is the challenge to have a sustainable business?

The drilling business is highly specialized, where contractors need to deliver high safety standards and a high-quality sample. Both of these demand for high capital investments from contractors, in terms of good machines, good professionals and a lot of training. Unfortunately, the last years have seen a bloody price war and mining companies have only focused on the final bill, which is not sustainable. Before, the exploration manager from the mine was the main person in charge of deciding the contracts. Today, the geologists are not the ones deciding; it is the administration teams that have the final word, and their focus is on the price most of the time. The question is, who will be responsible for this situation when problems come up, as a result of contractors that focused solely on capturing market share?

How is technology changing in the drilling business?

AK Drilling International invests a lot in new technologies. We were one of the first contractors to bring the most modern rigs in diamond drilling and RC drilling to the market. There is a trend for more digitalization and the use of parameters in order

to have a combination between the driller, who is an artisan with lots of experience, and the additional tools technology can offer. I do not think we will see a totally automated operation in drilling: at least for the next two decades; the human aspect will be very important because every hole requires a different analysis. There, AK Drilling International invests a lot as well: a good helper will become a good driller, and eventually an excellent supervisor or manager. We want our team to have a career path within the organization.

What are the pros and cons to developing mining activities in Peru?

Brazil has a bad reputation for corruption. Bolivia, Venezuela and Ecuador offer a perception of a State that intervenes in the private sector. Argentina is attractive with the new government but still has a long way to go. Colombia offers the 'páramo' challenge in terms of potential mining investments. Finally, Chile is expensive. By contrast, Peru has exceptional conditions for mining. The challenge is political and bureaucratic, not just on the government side, but also mining companies and contractors have become increasingly bureaucratic.

What are the prospects for AK Drilling International?

As AK Drilling International, we are focusing on cost reduction with respect to our collaborators and external clients, ensuring we implement sustainable strategies to keep the company in good shape. We know we are a services company and that as such we always need to deliver quality. Secondly, we want to continue diversifying, looking at specific opportunities in different countries. —

Global Business Reports

PERU MINING 2016

Industry Explorations

Noé Vilcas

General Manager
EXPLOMIN



How has the drilling business changed in the current cycle?

Today, safety is the most important thing for the client. Only after that, they start measuring your productivity and performance. As an example, let us say that we have to do a medium sized hole of 1,000 meters. That is done with 3 meter rods that are added one after the other. If you are at 900 meters of depth and you need to change the drill bit, you need to take all those rods out and then put them back in again. You are talking of 300 rods of 34 kg each. Before, you would handle these manually, meaning exposure for the operator's hands and fingers.

Today, the trend is to incorporate the latest equipment available in the market, like the rod handler or the rod feeder. At Explomin we have just bought five rod feeders from EDM in Chile, and we are sending those to Las Bambas, who asked us to acquire them. We have also bought two rod handlers for our reverse circulation rigs. All this helps increase safety and prevent incidents related to hands and fingers. These are strong investments (each machine costs between \$150,000 and \$250,000) that do not add direct value, because you are not going to drill more meters with them. However, they add indirect value, because they allow you to open doors with the world-class mining companies.

Can smaller family-owned contractors survive in this context?

In Peru there are a lot of small entrepreneurs in the drilling business that are suffering in this new environment. Local communities and former drilling employees invested in their own machines and companies during the good years, when the client would pay 25 or 30% of the contract in advance. Today, that is not the case: they do not pay a dollar upfront and some of them are asking for up to 90 days to pay the invoices. Also, you need about a month or 45 days to find all the team and have all the medical and relevant inductions. Some companies have 18-day induction programs, which cannot be done in one go, because they work under 14/7 working schedules, so you need 25 days to complete the induction. All this means that the contractors are effectively financing the mining companies for several months. Only big contractors with good

credit lines can afford to work in the current market.

What is Explomin's position in the market?

We are breaking our record of meters drilled because we have managed to obtain contracts in large mines. We are probably the largest player in Peru's drilling market right now. We are still present in Colombia, although the activity has been reduced there. We have a fleet of around 60 rigs, and 40 of them are working. As a strategy, we have decided to focus on volumes and longer term contracts, where mining companies also benefit from better rates.

What is your opinion on the current state of the mining and exploration industries?

Sometimes we live in a bubble and we think that Peru is everything. However, what is happening today is a consequence of the global commodity scenario. There are no new projects anywhere in the world. In Peru, the main obstacle has been the duplicity of regulations and permits. While the issue is being addressed now, the inflow of money for junior companies has completely stopped. Before, with \$1 million you could be sure that you would drill between 1,000 and 3,000 meters. Today, you will probably spend most of the money before you get your drilling permit.

Warren Buffett would tell you that today is the right time to invest, because costs are low, but due to cash flow issues, mining companies have had to restrict their brownfield and greenfield expenditures. There are some companies though, especially in the private spectrum, that are investing counter-cyclically and adding value to their properties. Yet, my impression is that the drilling market is shrinking once again in Peru.

Peru is a mining country. If you look at the figures, for every four or five projects that are built, there is one that is blocked. This is the same in other countries, although in other countries it happens through court orders, not social protests. Overall, I do not believe that things have gone badly for Peru. By the end of this year, we will have three of the five largest copper mines in the world. —

Miguel Ángel Arenas

General Manager
GEOTEC



What is the history of Geotec?

The company was started by the Boyles brothers 125 years ago in the United States. In Peru, the first job was the Michiquillay project, 58 years ago, where they used three truck-mounted rigs. Today, we are a joint venture between Layne Christensen, the largest water wells drilling company in the world, Boytec of Chile and Trapano SAC in Peru. We presently have a fleet of 62 drilling rigs: 57 diamond drilling rigs and 5 rigs for water wells and reverse circulation drilling.

All of our activities are devoted to surface mining, in either exploration or dewatering activities for open pit mines. Our main clients at the moment are La Granja, Yanacocha, Marcobre and Antapaccay. Up until today, we have not worked in the underground mining segment, although this year we are evaluating entering this business with a new technology. It is a technology that already exists in the market but which is not being offered in Peru. It allows you to drill more rapidly and efficiently. If we decide to enter the underground mining market, we want to offer a competitive advantage.

What business opportunities do you see in underground mining?

In 2016, the drilling market in Peru should amount to 1.2 million meters, 60% of which is underground. The peak for the drilling business in Peru was 2012, with 2.5 million meters. Today, the market is half the size in terms of volumes, while the value per meter has also decreased substantially. Right now, we are losing out by not being present in underground mining. It is a significant market.

As a large player, how can you be competitive in the current cycle?

Traditionally, we have had a 25-28% market share in the surface mining segment. For us, 2014 was a bad year but 2015 was very good, with 50% growth compared to the previous year. We were able to offer a more competitive rate to the market thanks to achieving more efficient processes. Today, Geotec is able to compete in price with a small family drilling company. Our advantage in low periods like this is that, out of our 60 machines, only 15 are working and, of course, it is the best 15 machines we have. Along with selecting the best equipment, we have also kept the best supervisors, drillers and technicians.

Generally speaking, I think that the bigger contractors are suffering more than the small ones. In 2012-2013, many companies acquired large debts to expand their fleets, and if you need your cash flow to repay loans and interests, you cannot offer rates that are competitive in the marketplace. Luckily, as Geotec we do not have any debt.

What efficiencies can you achieve through better training?

Today, drilling machines give a lot of information, such as the weight on the bit (WOB), revolutions per minute (RPM), liters per minute, etc, and it is a waste not to use it. Traditionally, drilling operators would change parameters depending on what they feel the machine needs. But we have real experts that can train our drillers to use the rigs more efficiently. Besides, we have an agreement with Halliburton. Every year we send personnel to Houston to get training in drilling fluids, which is a critical aspect.

What is Geotec's image in the market?

The market definitely sees us as a reliable and efficient company. We are probably the company that has trained more drilling operators in the country. If you look around our competitors, you will see many drillers that learnt the business in Geotec. We are also seen as a very solid company. One of our key features is that we have a very high technical availability; our machines do not stop. If a client asks us for four rigs, we send five to ensure we do not have any downtime. From a logistics perspective, we are very strong. —



Laboratories

A holistic perspective of projects

With the feasibility of exploration activities under pressure, adding value is also a recurrent theme for laboratories, which cannot obtain good margins just by providing the classic geochemical tests.

Now, the idea is to think of metallurgy and production from the very first stages of a project, explained Luz Blancas, commercial manager of Certimin, one of the largest laboratories in Peru: "Providing test results in a commoditized way is not the

way to go, you need to anticipate the clients' needs right from the moment they are exploring. Years ago, geologists were not involved in the metallurgical process, but today they want to know from day 1 if the mineral they have discovered is economically recoverable. You can easily save \$1 million if, instead of thinking of exploration and metallurgy separately, you plan them together."

By diversifying into metallurgical tests

with a mini-pilot plant and investing to expand its environmental capabilities, Certimin is now positioned to offer an integrated value proposition.

In the words of Miguel Caillaux, director of Certimin: "You can use part of the sample from the exploration campaigns for metallurgical tests, rather than having to obtain new samples. Obtaining a 20-30 metric-ton sample for a classic pilot plant test is very expensive. Our mini-plant handles 10-15 kg per hour, as opposed to 150-300 kg per hour in traditional pilot plants." SGS, a multinational company that also offers geochemical, metallurgical and environmental tests, as well as certification services for minerals trading, is also increasingly relying on metallurgical work to offset the decline of exploration activities.

José Luis Alván, vice-president of SGS' Minerals business in Latin America, gave more details on the company's capabilities on this front: "We started our metallurgy offering three years ago in Peru and it has been a good process. We can do flotation tests, grinding tests and cyanide tests, among others. The only things that we do not have here are the pilot plant and the mineralogy services, which we have in Chile."

Luis Felipe Elías, managing director of SGS in Peru, added: "Our main difference in Peru, with respect to local competitors and to other countries where SGS is present, is that having these four business lines within the minerals division, we can mitigate the risk of having one activity going down, like we are seeing today with the geochemical business."



Miguel Caillaux, Álvaro Salazar & Luz Blancas

MC: Director

AS: General Manager

LB: Commercial Manager

CERTIMIN



How have you improved your service offering to adapt to the current market?

MC: The problem for all service providers to the mining sector is that, due to the lower metal prices, mining companies have undertaken very aggressive policies to reduce costs. In many cases, we see that the purchasing processes are strongly influenced by logistics managers rather than technical managers. The challenge, in this context, is to ensure that quality is not affected. Luckily, we have been able to offset this trend through diversification. Our metallurgical service has been key in this respect, because the tests we offer help companies improve their recovery rates and increase their margins. In the environmental division we have also made significant investments to offer virtually all the environmental tests in-house, without having to recur to third-party laboratories, so we have faster response times.

What are the main drivers for Certimin today?

AS: The company has three main divisions: exploration, metallurgy and environmental; the latter is related to the companies' obligation to comply with the regulations. Exploration activities have decreased due to the lack of funds, social problems and other aspects. Meanwhile, mining companies are giving priority to improving recoveries to increase their revenues today, while some operators are actually delaying their brownfield exploration. Right now, the main areas of focus are the metallurgical and environmental services.

Do you run laboratories at the mines sites?

MC: We also manage laboratories on-site. We are happy that we just renewed our contract with La Arena, today operated by Tahoe Resources, and we have also won the contract for Shahuindo. We are open to develop this business in mines outside of Peru, so we are ready to follow the clients in countries where we would be comfortable with the business setting.

AS: Some companies just want the technical staff to operate their laboratories, which may have old equipment. In our case, we prefer to invest in our own equipment, because you need top quality and high speed: mines need results in a matter of hours.

Could you give us more details on the metallurgical services you offer?

AS: Metallurgical tests are oriented to obtaining better mineral recovery rates for plants that are already in operation. There are not

many new projects being built, but all existing operations need to be more profitable, and this is where all these tests come into the picture.

MC: When you want to design a new plant, you need to have samples that are representative of the whole ore body. With a sample of 600-1,000 kg we can have a good test to define the dimensions of each part of the process. In the case of companies that are already operating, they need to make adjustments because the mineral they are processing today may not be the same mineral they had at the beginning. Small pilot tests can be very precise and scalable to larger operations.

How has Certimin's value proposition evolved in this respect?

LB: Providing test results in a commoditized way is not the way to go. Our value proposition is not to sell one test, but to provide a comprehensive service that covers the whole value chain of the client, and which includes research. We anticipate the clients' needs right from the moment they are exploring. Years ago, geologists were not involved in the metallurgical process, but today they want to know from day 1 if the mineral they have discovered is economically recoverable. Geological reports increasingly incorporate metallurgical aspects because economic feasibility is key. From a client's perspective, there are many ways of optimizing costs. You can easily save \$1 million if, instead of thinking of exploration and metallurgy separately, you plan them together. AS: With the fall of mineral prices, many projects have become non-profitable. Companies that acquired projects over the last years have had to write significant values off their books. So, it makes sense to incorporate the metallurgy from the beginning, to have a clearer idea of the real value of projects.

MC: This also means that we need to handle the samples differently. If you plan in advance, you can use part of the sample from the exploration campaigns for metallurgical tests, rather than having to obtain new samples. Samples age and oxidize, so you need to keep them fresh and that needs to be managed properly. If you do not have the right sample, all you can have is gross estimations that cost money in the long run, because the tests may not be valid to design the plant. Obtaining a 20-30 metric-ton sample for a classic pilot plant test is very expensive, while our mini-plant can work with just 10-15 kg per hour.

Luis Felipe Elías & José Luis Alván

LFE: Managing Director
JLA: VP Minerals South America
SGS



LFE



JLA

What are your main business lines in Peru?

LFE: Here in Peru we have a team of 1,800 people working in different divisions. We have an agricultural division, an environmental division that applies to various sectors, an industrial division in charge of services such as construction supervision and non-destructive testing, and the OGC division (oil, gas and chemicals), that performs different services in upstream, midstream and downstream operations. We also have the certification division, which has been renamed this year as 'Certifications and Business Enhancement'. It provides the different ISO and OHSAS certifications, and also undertakes homologation, performance assessment and training services. The company is really focused on developing the training business worldwide. Finally, the main division for us is the minerals division, which covers four business lines: geochemical analysis, metallurgical analysis, on-site laboratories and trading. We have a strong presence and market share in Peru's mining sector.

What trends do you see in the minerals section?

JLA: Companies have cancelled their exploration activities to a great extent, so volumes in that business have decreased dramatically over the last couple of years. Luckily, we were flexible enough to manage the situation and be prepared for a market comeback. The trading business is the most inelastic one; there has to be a disaster in the industry before trading is really affected. Clients are pushing for lower prices but our business is still very strong, with bigger volumes. Then, we are the main sup-

plier in the country of on-site laboratories. LFE: Our main difference in Peru, with respect to local competitors and to other countries where SGS is present, is that having these four business lines within the minerals division, we can mitigate the risk of having one activity going down, like we are seeing today with the geochemical business.

JLA: For the minerals business, Peru is a key country worldwide for SGS. It is in the top 10 in revenue and in the top 6 in profitability. Chile is the number one country for us, and South America is our most important region for the minerals division.

How important has it been for SGS to implement the metallurgical business in Peru?

JLA: We started metallurgy three years ago and it has been a good process. In terms of the investment, there is more to it than just the equipment; we brought a metallurgical leader from Chile to implement the business for the initial period. We can do flotation tests, grinding tests, cyanide tests and others. The only things that we do not have here is the pilot plant and the mineralogy services, which we have in Chile. We have some long-term, five-year contracts with clients, where we receive tests every month. Yet, this business has only started recently so we need to be proactive and look for new customers to fill up our capacity.

Are mining companies increasingly outsourcing their on-site laboratories?

LFE: You need three-year contracts at least, so you can invest in the necessary equipment. As SGS, we do everything in the

mine laboratories: geochemical analysis, processing tests, concentrate tests... we run the whole lab for the mine. The idea of being there is that the clients need quick results and they take decisions based on those. In this context, quality is key: the facilities, the equipment and the people need to be word-class.

What are SGS' competitive advantages?

LFE: We have a dual strategy: being global and being local. Our global expertise and coverage are very important, but also, you need to understand the needs of every client in each of the regions and countries. We have launched a service excellence project here, related to our customer service: clients need to know that they can rely on us. We have a big structure but we need to be flexible, responsive and understanding with the clients' needs. The moment you are a big company that is slow to react, you are lost.

JLA: Urgency depends on the business. For one division, business urgency may mean three days; for another business it may mean two hours. We need to be flexible according to the different business lines.

What growth opportunities do you want to pursue within Peru?

LFE: We see different opportunities in the country. Technical training will grow as a business; also the industrial division. Peru needs, no matter who is in government, a big infrastructure program because there is an enormous deficit. We need highways, ports, roads, bridges, airports, you name it. As SGS, we will be present along that process and the industrial division will be key for our growth. —

Blasting Solutions

R&D efforts are paying off

The reduction of copper prices during 2015 brought pressure to the open pit mines to reduce blasting costs, as mining operations use large volumes of explosives on a regular basis.

Peruvian blasting solutions company Exsa introduced Quantex in 2014, and clients like Southern, Yanacocha, Gold Fields, Hudbay and Tahoe have rapidly made the shift towards this technology.

According to Gustavo Gómez Sánchez, Exsa's general manager, besides the operational and environmental improvements, the impact on the final bill is remarkable: "With Quantex, we can save up to 50% in diesel consumption when preparing the explosive mix. Also, at the moment of applying the product, you can regulate the density you need depending on the type of rock."

"Then there is the environmental performance," Gómez Sánchez continued: "Quantex reduces significantly the risk of releasing red fumes while carbon emissions are also reduced. We have proven that we can reach savings of 30%. As an example, Southern Copper saved \$16 million over the course of a few months by shifting to Quantex." ▶ 126

Discover Quantex.

The Most Innovative
Technology in Rock
Fragmentation.

This technology reduces the total blasting cost by up to 30%.

Some of the benefits:

- Savings in purchase and operational costs.
- Significantly enhanced operational performance.
- Applicable in any conditions, even in dynamic waters.
- Environmentally friendly technology [18% lower carbon footprint].



Main Office:
Las Begonias Street 415, 12th Floor
San Isidro - Lima 27 / Peru
Zip Code: 4244 Lima 100 - Peru
P: (511) 315 7000
EM: info@exsa.net
Find [f](#) [t](#) /@Exsasoluciones



Gustavo Gómez Sánchez

General Manager
EXSA



How has the blasting market evolved over the last year?

The market continued to be tough during 2015. Copper prices, which were not affected in 2014, went down last year and this had an impact, even if we had good projects reaching full capacity, such as Toromocho, Las Bambas or Cerro Verde. If we speak about volumes, the underground market has remained flat while we have seen an increase in the open pit mining segment thanks to the new projects that have come online. Customers, however, have kept their focus on cost reduction.

At EXSA we have continued to focus on integrated solutions to reduce the overall blasting costs. In open pit operations we have consolidated our presence with the Quantex technology, which we launched in 2014. In terms of sales, we had a turnover of \$171 million last year, which was lower than in 2014. Most of this revenue comes from Peru, because in Colombia the volumes are still small, and in Chile we are still putting together the structure of our company to start generating revenue there, with a clear focus on the Quantex technology. In Peru, we have recently invested \$40 million in a new initiation systems plant, by far the most modern one in the region.

How does the revenue break down into open pit and underground mining?

65% of our sales come from open pit operations, the rest coming from underground mining and the construction business. In open pit, we have seen a rapid shift towards the Quantex technology, which already represents 40% of the total volumes in that segment. We have achieved that in just one

year. Clients like Southern, Yanacocha, Gold Fields, Minsur, Hudbay and La Arena and Shahuindo (Tahoe) are already using Quantex; at El Brocal we expect to complete the shift soon, while in Chile we will be carrying out some Quantex tests with potential clients soon.

Additionally, last year we got the patent for the Quantex technology for the North American market. This will help us take this technology to markets outside Latin America. In the short term, we are focusing on consolidating our market share with Quantex in the region, but we could certainly evaluate proposals by potential partners to commercialize the technology in other parts of the world.

Could you refresh our readers about Quantex' main features?

In terms of the product, the main difference with the traditional Heavy ANFO is that Quantex uses high-density ammonium nitrate instead of porous ammonium nitrate. The other pillar of the Quantex technology is the operational efficiency: for instance, we can save up to 50% in diesel consumption when preparing the explosive mix. Also, at the moment of applying the product, you can regulate the density you need depending on the type of rock; with the traditional heavy anfo, you cannot. You can use just the right amount you need for every particular application.

In a nutshell, you have a lower-cost product, lower operational costs, and also better environmental performance: Quantex reduces significantly the risk of releasing red fumes while carbon emissions are also reduced. When we launched the technol-

ogy, we projected savings of 20%, but we have proven that we can reach savings of 30%. As an example, Southern Copper saved \$16 million over the course of a few months by shifting to Quantex.

Do you think in the future we will see more continuous drilling technologies in the blasting business?

As of today, the chemical energy from the explosive is more cost-efficient than mechanical energy. Having said this, at EXSA we have a vision to offer rock fragmentation services. Today, the explosives are the best way to achieve that. We strongly believe in innovation, and Quantex is the most recent achievement of that philosophy. If, in the future, there are new technologies that bring new efficiencies, we will embrace them.

How can you contribute to increased safety standards in the mining industry?

Accidents in the mining sector decreased in 2015. This is a positive development, thanks to big efforts by the different mining companies and their providers. These efforts go hand in hand with the implementation of safety regulations by the different governmental bodies. From our perspective, safety is in our DNA because we handle explosives in our operations and mining presents serious risks. We have a strategic alliance with DuPont in our training center, the Blasting Technology Center. What we are trying to do is go beyond the quality and the safety of the products, as well as beyond the safety processes, to touch upon the conduct of all the workers. —

Gustavo Costa

Country Manager
ORICA



What have been the main milestones for Orica over the last years?

The first milestone was the expansion of a world-class copper producer in the Arequipa region for a client with whom we have worked since 1998. This project has been a great challenge in terms of products, personnel and efficiency. The second milestone is a new copper producer in the Apurimac region: we are finishing the ramp-up with six trucks moving nearly 2,000 tons of emulsion explosives monthly; we also provide them with all the initiation systems. This was a special project for us because we had to become part of the local community. It is a very remote location and we had to provide intensive training to respond to the rapid production increases during ramp-up. Another project that had a good increment in terms of its volumes is a global mining company in the Cusco region. Overall, the southern region has seen very significant growth.

What is your production capacity in Peru?

We have two production plants in Peru: one in Lima and one in Congata, near Arequipa. We have recently doubled our capacity in Congata. The project was completed in May 2016. In Peru we produce the emulsions, while all the initiation systems are imported

from Chile from our plant in Antofagasta. For ammonium nitrate, in Latin America we have sourcing contracts with third parties.

How can Orica help clients be more efficient?

We usually try to optimize our resources. For example, in a recent project we have nearly trebled our production capacity per person. We have achieved many synergies, while we have also worked on new high-energy blasting solutions to improve production ratios. In another project, we have also been working in the last months on the introduction of a new product that has improved efficiency in transportation and in the optimization of drilling patterns.

Could you give us more insights on your different product lines?

Over the last years, we have been working on energetic emulsions that can help customers in their mine-to-mill processes. As part of this, we have consolidated our Fortis Extra (200) emulsion and Vistan series (225). We also have a Vistan 250 product, which is the maximum in terms of energy capacity; and, below the Fortis Extra, we have the Flexigel line, which is used in those cases where you want to prevent damages to the slope or a nearby facility. A big copper producer in the central Andes

of Peru decided to go for the Vistan 250. In terms of the results of the blasting process, they needed to increase the amount of fine material (below one inch) from 20% of the total to 42%. We did some tests with the Vistan 250 and obtained the results required. When you increase the amount of fine material, you are actually increasing the throughput by several percentage points, boosting productivity. That is where the money is. Now, we are also working with another big mining company on the same issue, trying to obtain around 40% of fine material.

What is Orica's participation in Peru's rock fragmentation market?

The market in Peru is in the range of 450,000 to 480,000 metric tons per year. As a single mine, Antamina is the largest user of explosives, with about 7,000 mt/month. With the expansion, Cerro Verde now uses 5,000-5,500 mt/month. Company-wise, the largest user is Southern at Toquepala and Cuajone, with 8,000 mt/month. As Orica, we have a 35-38% market share in bulk explosives and a 60-65% market share in initiation systems.

Do you think one day we will see a rock fragmentation process without the use of explosives?

Last year, Orica opened its Center of Innovation and Collaboration in Santiago, to carry out research on how to make the mining process more efficient, working together with our clients. Today, the chemical energy of the explosive is still the most economic one for rock fragmentation. This does not mean that it could not be replaced in the future: we have seen technology substitution happen many times in the past. In our R&D center we are already looking at alternative technologies.

What would be your final message to the industry?

Peru has a buoyant mining industry and is also developing a lot from a technology point of view. The challenge for the whole industry is to continue moving towards better technology and more efficiency. The industry must also understand that the different providers are essential in this process, so mining companies and providers need to work hand in hand with an open mind. As Orica, we want to position ourselves as the main technology referent in rock fragmentation services. —



CLEVER RESOURCEFUL SOLUTIONS

At Orica, we're focused on developing long-term partnerships which reduce total life cycle costs, improve productivity and enhance your licence to operate.

We combine our global R&D team's progressive thinking with the expertise of our technical team to find solutions that meet the daily challenges of your operation.

To find out more about our offer, contact our Peru office at (+51-1) 217 6000 or visit www.órica.com

Blasting Systems
órica.com



◀ 123

Surface mining represents 65% of Exsa's revenue. Gómez Sánchez explained that they are working on new developments to increase efficiencies for underground mining as well. Besides which, the company is completing the construction of a new initiations system in the country, which represents a \$40 million investment. Another big player in rock fragmentation is Orica, a company that is serving large open pit and Antapaccay. According to its country manager in Peru, Gustavo Costa, the pressure to reduce costs in a context of lower copper prices is translating into better logistics and personnel management, and into a search for new technologies that can yield better productivity. For two of their clients, for instance, the company is working on higher-energy explosives that can increase the amount of fine material (below one inch) obtained from blasting from around 20% to over 40%. "When you increase the amount of fine material, you are actually increasing the throughput by several percentage points, boosting productivity. This is where the money is," said Costa. According to Costa, Orica has a market share of around 35% in bulk explosives and a 60% participation in initiation systems. The company has increased its manufacturing footprint in Peru, as it has recently doubled capacity at its Congata emulsion explosive plant, near Arequipa. —

Legal Issues and Risk Prevention

*Food for thought from
industry specialists*

“The risks depend on every operation. It is not the same to fund a project with cash as it is through borrowing, which brings up requirements from lenders. Environmental risk is a major concern. Then, you can make informed decisions on regulatory risks more easily than on social risks, which can flare up at any point in the project. Latin American miners tend to transfer more risk than other miners around the world, due to factors such as earthquake exposure. Post-Samarco, you may have more managers in Latin America worried about reputational risk, because it is in the headlines all the time.”

- Tom Holliday,
Head of Mining Latin America,
Willis Towers Watson



“With the exception of cases where an operation needs to shut down, the labor legislation does not include any particular treatment for a mining company that is suffering from low commodity prices. If companies need to downsize, they just assume the labor costs of doing so. Although workers benefit to some extent from profit-sharing when prices are high, they should not be left unprotected in lower cycles. I think that the current regime is reasonable.”

- Valentín Paniagua,
Partner,
Estudio Eche copar



“There has been a lot of new regulation over the last years and, even if the regulation is very good, the process can be complex for companies until most understand how things work in practice. Overall, my impression is that the number of required permits has gone down, but the perception of investors and companies is exactly the opposite. The government needs to work on reversing that perception.”

- Luis Felipe Huertas del Pino,
Partner,
Osterling Abogados



“Before, the idea of risk was a fire, an earthquake or a robbery. Today, the risks are much wider. There are social risks, reputational risks and financial risks. Catastrophic events such as earthquakes and floods are increasingly likely and intense, and we must look at business continuity plans (BCPs) and contingency business interruptions (CBIs). This goes beyond the direct risk to the insured facilities: for instance, after Fukushima, many companies in the automotive and electronics business who were not based in Japan had their supplies cut off as a result of damages that happened very far from their facilities.”

- Giulio Valz-Gen,
General Manager,
Contacto



Outsourcing Services to Specialists

Avoiding unnecessary headaches



Image: Consorcio Minero Horizonte

Peruvian miners are not as inclined as their counterparts in Australia or North America to outsource all sorts of non-core services, but they are increasingly realizing that they can actually save themselves a lot of headaches by doing so. Following a high-profile robbery of gold in Juliaca's airport last year, mining companies in the precious metals spectrum are looking at how to reduce this sort of risk from the moment they produce a gold bar until it is actually exported.

Hermes, a company dedicated to the custody and transportation of valuables, is going beyond the traditional 'point A to point B' transportation service to offer the complete vault management service within the mines. Marcos Olórtegui, director of Hermes' mining business, explained the advantages of this system: "Vault management works in a way whereby the client gives us the gold bar the moment it is produced and we take responsibility for it from that precise moment. This means that we actually operate the client's vault. At the same time that the risk of theft decreases, the mining company's insurance costs go down. Also, with the vault you can optimize the number of trips you need to take the mineral out of the mine."

The company is already providing this service to three mines in Peru and expects to consolidate this offering with two more clients this year.

Although not as sensitive, the management of the mines' vehicle fleets can also become a nuisance. If, in the past, mining companies dealt with all the admin work attached to buying vehicles, managing the insurance policies and selling the used units in the

“

As Sodexo we are present in 80 countries and we and serve 75 million meals every day. The energy and natural resources business represents 8% of the company's total revenue worldwide, but in Peru it accounts for 80% of our business. Sodexo entered Peru 18 years ago with Antamina as its first client. Today, we have 6,000 employees in the country, with 100 sites in operation.

- Alfredo García Pye,
President,
Sodexo



”

second hand market, many mining companies and contractors have decided that the potential savings are not worth the man-hours behind it. This is where the renting business has a big window for growth.

Avis, for instance, only started in Peru in 2013 and is expecting to close 2016 with a fleet of 1,200 vehicles. Its general manager, Fernando Martínez, affirmed that renting only represents 0.2 to 0.3% of the country's vehicle fleet, when 3 or 4% would be a more reasonable figure. While the target client for renting services are those companies that need replacement cars every two to three years, like mining companies, Martínez believes that many other businesses have a lot to win by switching to renting: "Today, companies do not buy computers; they go to one big brand such as Dell or HP and pay for a package that includes the renewal of the units every few years. The same applies to vehicles, because managing fleets is not the core business of companies."

Human resources can be another source of headaches for the industry, especially during project construction, when thousands of people get involved. While the specialized contractors take care of their own pool of workers, there are always auxiliary areas that do not demand very high skills.

In Peru, temporary staffing services are very much restricted by the legislation, so multinational human resources specialists like Adecco have become contractors in their own right for those services that the large construction players will not handle but which are still needed across the life of a mining project.

Fernando Llosa, Adecco's director of outsourcing, explained: "Complementary activities include the installation of geomembranes and HDPE piping, the cleaning of the facilities, or the management of community projects like a fish farm. At Cerro Verde, for instance, we do the maintenance of the concentrators. We were also present for three years during the expansion project, where we handled all the facility management."

As outlined in this report, achieving efficiencies is not just the result of cutting costs here and there. The mining operation has many phases and rethinking policies and strategies can pay off, especially nowadays, when there is a wide variety of specialized service providers that can deliver great performance at competitive costs. —



Arrive at your best

Avis cares about your business as much as you do.

We are the strategic partner your business requires for your fleet administration.

Contact us to learn about our business services in renting (long term rental) and short term rental.

☎ (51-1) 207-6000 - 📱 Avis Peru
reservas@avis.com.pe - www.avis.com.pe

AVIS

Fernando Martínez

General Manager
AVIS



How has the business grown since you began your activities in Peru?

We started in Peru in 2013 and today we are a relevant player in the business. We have a fleet of 850 vehicles, and we will end 2016 with around 1,200. We are growing faster than the market. We have moved to a new facility in Javier Prado which includes our own workshop, so we can do maintenance in-house and offer more competitive rates to the clients. This facility also has a rent-a-car counter, which complements very well our other two locations in Miraflores and the Jorge Chávez airport.

Was it very difficult to start back in 2013?

It was not easy, but today we have a very robust team. We have 65 people in the country and we should have 75 by the end of 2016. We already have a workshop serving Pan American Silver's mines, as well as another mobile workshop that has been working around different mines, so we have a good track-record. We have diversified our client base to the point that we work with over 100 companies. Also, last December we got our ISO 9001 certification from Aenor; the process involved lots of hard work but it was totally worth it.

How does the ISO certification translate into a better service?

Many companies provide a great service and do not have an ISO certification, yet if you have a client that wants to ensure all processes are spotless, having the ISO 9001 works as a great introduction. On an operational level, this is a complex business and the ISO gives us a greater focus on meeting the clients' expectations, with many tools to measure these on a regular basis, including internal and external audits.

How could you increase your market penetration in the mining industry?

In the mining sector, there are many cases where mining companies ask the local communities to buy vehicles and provide services to the mine. From the mining company's point of view, it is understandable to use this approach, because a good relationship with the community is key and they want to contribute to local development. Having said this, local communi-

ties do not have the expertise to provide these services like a more professionalized company with all the certifications would do.

If you take into consideration all the costs of owning the vehicles versus renting them, you need to think of the administrative work related to managing the insurance policies, the tyres, the downtime, the maintenance and the sale of the used vehicles. All this costs money and man-hours. Our solution focuses on the mine's productivity. You still find mining companies that do own some vehicles, but the trend will increasingly be to favor the renting option.

What is the challenge to manage a highly diversified client portfolio?

We need to work with all sorts of clients. A new contractor may arrive in the country and need two vehicles for its managers, and all of a sudden that company may get a contract and need hundreds of vehicles. Some companies just want the lowest cost, others do consider value-added services and provide check-lists that we need to comply with. All customers are valuable. Giving the right quote is essential in this business. We need to be sharp when quoting the service but calculating the rate is not as difficult as it may sound. There are a number of parameters to be taken into consideration.

What are your expectations for the medium term?

There is great potential for growth. Renting vehicles amount to 0.2 to 0.3% of the overall fleet in the country, when it would be very reasonable for it to stand at 3 or 4%. The main clients for renting are those who use their vehicles intensively and need replacement cars every 2-3 years, for instance mining clients; but today, many companies in other segments, who used to buy their own cars, are now considering a renting solution, in the same way that happens with computing equipment. Today, you do not buy computers; you go to one big brand such as Dell or HP and you pay for a package that includes the equipment and the relevant service. Computers are renewed every few years, and you forget about the related headaches. The same applies to vehicles, because managing fleets is not the core business of companies. It makes sense to outsource. —

Fernando Llosa

Director Outsourcing
ADECCO



How is Adecco present in the mining industry through outsourcing services?

Adecco is the largest human resources company with a presence in 160 countries. We have done outsourcing internationally for over 20 years, and in Peru for 11 years, where we have three main pillars in this line of work: the industry and manufacturing business; the retail, sales and trade marketing activities; and finally the mining, oil and gas and energy industries. In mining, we offer complementary services to the operators' core business, in areas such as minor civil works and facility management. We work with exploration companies, mines in construction and mines that are already operating. Complementary activities include the installation of geo-membranes and HDPE piping, the cleaning of the facilities, or the management of community projects like a fish farm. At Cerro Verde, for instance, we do the maintenance of the concentrators. We were also present for three years during the expansion project, where we were doing all the facility management.

How would you describe Adecco's positioning in the industry?

A few years ago, due to regulatory changes in Peru, the business of temporary staffing had to move towards the contracting model, whereby we had to take responsibility for the project and the people involved in it. We are registered as mining contractors, but we are not present directly in things such as mining exploitation or mineral processing. We are like a Swiss knife: you will not use it for a very large job, but you can use it for many different things. Both mining companies and large contractors have needs in complementary services where we can be of great help, because that is not their core business. In construction projects where you have many people and you need to be very agile, we can offer that flexibility.

How difficult is it to set up the teams for these temporary contracts?

We work a lot with the communities around the project, because that is actually a requirement from the clients. In many cases, local communities do not have enough preparation to carry out the

different jobs, so we take care of providing all the training required. We work hand in hand with the community relations department of the mining company. This is a very sensitive area for mining operators: they do not want to leave it in the hands of a third party, because local communities can stop a project at any moment. For a project, we can have people with a university degree, people with a technical degree and unqualified workers. What happens a lot is that the mining company often offers a position to some of our workers, which is a sign that we are doing things the right way. It is difficult to find qualified people, so when projects finish, we typically do our best to relocate our key staff, even if the process sometimes takes two or three months.

Would you consider undertaking larger civil works contracts?

We have big financial shoulders and we could invest in equipment to do contract mining, however that is not our specialty. We are not going to start competing with the large contractors, who are also our clients. As an example, we do all the facility management for the Jorge Chávez airport in Lima, but all the specialized maintenance is carried out by the different contractors like Thyssenkrupp and ABB.

What are your goals for the near future?

Our experience in the mining industry in Peru is quite unique for Adecco worldwide, because we work at a contractor level. Peru has seen many new projects over the last years, and that, coupled with the regulatory changes that made temporary staffing very difficult, has pushed us to where we are right now. Today, Adecco is putting a lot of emphasis on outsourcing, worldwide. It is one of our strategic pillars for the future. From a shorter term perspective, the last year has been quite tough because many projects have been delayed, due to social issues and low metal prices. In this context, service providers are fighting for a portion of a smaller pie. We are defending our position in Barrick, Toromocho and Cerro Verde, while we are trying to get work in other operations where we are not present like Las Bambas. —

Power Generation

Peru's competitive advantage

Peru offers very attractive power prices since natural gas revolutionized the country's energy matrix in 2004, and this has certainly helped the development of large mining ventures over the last years. While some mining companies, such as Buenaventura or Horizonte, already operate their own power generation plants, the truth is that today the national grid offers a surplus of energy, due to the subsidized investments in new power plants over the last years. That surplus, coupled with a sudden downturn in mining investments, helped some mining operators to obtain very competitive rates from energy providers, as was the case for Hudbay Minerals at Constancia. To give another example, Dynacor Gold, a toll processor, is dramatically decreasing its energy bill this year at its brand new Chala plant, where it can get rates of \$0.08 per kilowatt hour (kWh) as compared to \$0.25 at the Huanca facility, which is not connected to the national grid.

Over the last years, the State launched auctions whereby it awarded projects to different power generators, guaranteeing them an energy sale price to cover their risk. The aim was to create a strong power generation base to support further investment in mining projects and economic development. This has been achieved, but incumbents in the sector, represented by the SNMPE, are now asking the new government to stop subsidies to new players in order to ensure the sustainability of the system. As investment in new large power plants will be delayed, providers in power generation technologies and services will turn their attention to industrial consumers in segments such as mining. There, they will be able to offer not only new auto-generation solutions, as wind and solar energy technologies are now available at very competitive prices, but also all the services related to maintenance and technical optimization.

Image: Vertisub



Juan Carlos Castañeda

Energy Service Country Lead
SIEMENS



How can you help clients in power generation services?

In Peru, Siemens installed its very first turbo-generators (2 x 100 MW) in 1993 in the district of Ventanilla; another power generation plant followed in 1996 in the district of Barrios Altos. However it was not until 2004, when Lima received the gas from Camisea, that the development of thermal plants took a sharp turn towards growing lane, as if the gas coming from the jungle of Peru injected the city and the energy sector with some kind of miracle tonic. Since 2004, in Siemens we have grown from 420 MW to nearly 3 GW, in terms of the installed capacity we handle. We can help customers not just on the maintenance of our equipment, but also we can provide advisory services on how to optimize their resources and production. Some of our customers need to produce as much energy as possible; others do not have energy selling contracts (PPAs), so they are unable to sell it; some others have fixed contracts for

gas usage, so they need to pay for it, regardless of whether they use it or not. We can provide different recommendations and solutions for each situation.

What areas of business do you cover?

Our installed capacity (which is more than 50% of the thermal generating capacity of Peru) requires maintenance and scheduled services throughout the life of the equipment. We partner with our clients through long-term programs (LTPs), to ensure the reliable operation of our equipment. Our products not only include gas, oil, steam, and wind turbines for power generation of large and small industries, but also compressors, blowers, and pumps.

What are the main phases of a long-term contract?

An industry that runs our turbines 24/7 will have an operating profile of approximately 8,333 equivalent operating hours (EOH) per year. Although the terms of the LTPs are flexible and mostly based on what our customers request, they normally cover the units for 100,000 EOHs divided in two cycles. At every 50,000 EOH we perform a comprehensive overhaul, which gets the unit ready for its next cycle of operation; in addition, each year in between, we perform minor inspections on the sections that are subject to extreme loads and temperatures. We also offer condition-based maintenance services, which are more flexible and adapt to the operation of the unit, especially if the customer does not use the equipment as much.

What is your focus for the medium term?

In past years, we focused a lot on the larger turbines, but now we are dividing our attention to the smaller industries. The trend towards auto-generation and sustainability is creating the need for greener buildings and smaller energy solutions, so the requirement is for alternatives such as mini-hydro plants of 20 or 30 MW or small wind farms. This is where we can offer solutions to customers that are not necessarily the huge operators in power generation, but may need small energy solutions ranging anywhere from 5, 10 or 20 MW in industries such as mining, plastics, textiles, or even sugar production.

Transportation and Logistics

The country's infrastructure needs to catch up

Mining operations are typically in remote locations in the Andes where access is difficult. A mining executive illustrated this issue with the case of Las Bambas. According to him, it takes longer to reach this mining operation from Lima than to fly to Spain. Of course, if this is the challenge for moving people in and out of the mines, one can imagine the sort of difficulties that companies encounter for cargo logistics, especially at the project phase where large pieces of equipment need to be transported around the country.

According to José Antonio Valle, managing director for Latin America at MIQ Logistics: "Peru has a tremendously poor infrastructure. There are not enough roads and ports. Airports are ill-prepared for the logistics chain. You cannot bring a Boeing 747 to Tacna, because you only have the equipment to unload the plane in Lima. You need special planes like the Antonov, increasing freight costs dramatically."

MIQ Logistics handled the project cargo for Toromocho and the expansion of Cerro Verde. The first one was very challenging from a logistics perspective, because everything had to reach the mine using the saturated Central Highway. "We had to break the mills into different pieces, due to the limitations of the road," Valle said. Once the project phase is over, challenges continue during the operations. In the case of precious metals, longer logistics chains mean longer times to export the material, increasing the risk of theft. Meanwhile, copper mines exporting concentrates face the challenge of high costs to take the mineral from the Andes to the Pacific coast. Both Cerro Verde and Las Bambas are using the railway to take their concentrates to the port of Matarani in the south of Peru,

however this infrastructure is very limited. PeruRail, the operator, actually provides a 'bi-modal' solution to transport the mineral with trucks where there is no railroad. As an example, for Las Bambas they need four trains, but also 260 trucks daily.

This lack of infrastructure creates transportation costs that are not attractive to some copper mines in the south. Hudbay Minerals, for instance, operates the Constancia copper mine, which does not use the railway. Cashel Meagher, senior VP and COO of Hudbay, gave more details on the political implications of pushing for more rail infrastructure: "Clearly, it would be better to take the trucks off the road, but, in the meantime, the rail is not a cost effective solution. With Las Bambas, Antapaccay and Constancia all having mine-lives of over 20 years, it makes sense to extend the rail line, but there are also political and social pressures that stop that development, because many of the existing trucking companies are from that area. If you bring the rail, you may have other social issues you do not want to have, so it is a catch-22," Meagher concluded.

Moving forward, though, the country can only benefit from better infrastructure. Large copper projects are multi-billion ventures, and mining companies are not likely to invest those sums if they perceive that the project will incur high costs over the life of the project. In this respect, Ricardo Vega, president of OHL in Peru, defended the need for more public-private partnerships: "The State is slow to launch new infrastructure projects, but there is a problem of resources as well. A country like Saudi Arabia has the shoulders to finance large projects, but in Peru the State needs to be more proactive to forge alliances with private players."

Alberto Valdez

General Manager
PERURAIL



Could we have an overview on PeruRail's operation?

PeruRail started its activities in 1999, when the government was launching the rail concession for the private sector. Since then, we have been providing passengers and cargo transportation services. On the passenger side, we operate the route between Cuzco and Machu Picchu, which is Peru's flagship tourist attraction, while we also have some trains that link Cuzco with Puno. In cargo services, we link the Matarani port and Cuzco and Puno, where we take mostly fuel, and we also provide the minerals transportation service from the mines to the port of Matarani.

What has been the impact of increased mining activity on your financials?

The revenue from the cargo service has increased significantly due to the contract with Las Bambas and to the expansion of Cer-

ro Verde. We have been working with Cerro Verde since 2006, so by the time we signed the contract with Las Bambas we already had a proven track record of working with a world-class mining operation. Although Cerro Verde produces higher volumes than Las Bambas, the latter has required higher capital expenditures for us because the mine is located farther away from the coast. We have not built new railway infrastructure, but we have developed a bi-modal system whereby we do part of the route by road and the rest by train. In the case of Las Bambas, we are working with 260 trucks and four trains daily. At Las Bambas we are going to move around 4,000 metric tons per day (mt/d), while we move 6,000 mt/d at Cerro Verde.

Southern Peru is already one of the world's key copper producers. How could rail infrastructure enhance this development?

Southern Peru is already home to large copper operations, such as Antapaccay, Constancia, Cerro Verde, and Las Bambas. There are other projects in the pipeline in that copper corridor, such as Coroccohuayco. Therefore, it would make sense for the government to develop the infrastructure to support mining investments. While the government has no specific plans for this, the only solution for us is to find alternatives combining rail and road transportation. We are always looking at optimizing our costs, being able to transport more weight per axle, and having more efficient locomotives.

Víctor Sam

General Manager
TRANSPORTADORA CALLAO



Could you provide some background information about Transportadora Callao?

The initiative to create Transportadora Callao was born of the necessity of Peru's mining industry to have a specialized minerals terminal. Before our project was built, the exportation process was very slow; it generated a very dense traffic of trucks between the storehouses and the port. We started operating in May 2014 and we have already handled over 5 million metric tons of concentrates, eliminating 170,000 trips between the warehouses and the terminal. Everything is handled by our tubular belt. The belt is connected to the warehouses of Impala and Perubar, and the Impala warehouse is connected to the central railway, which receives the concentrate from Chinalco and other mines. Last year, we handled 3.3 million metric tons between the different warehouses: Impala, Perubar and Dreyfuss. In total we have identified 18 clients. Most of the concentrates we handle are copper, lead and zinc. To a lesser extent, there is also silver.

How does your business work under an operational perspective?

We are a private joint venture between Impala Terminals, Perubar, Chinalco, El Brocal and Tramarsa, who acts as the port operator. We provide services that are regulated by Ositrán. Today, the rate is \$7.52 per wet metric ton. We do the transportation between the open access area and the ship, and we also have a rate when the ship is moored in our area, depending on the size of the ship and the amount of hours it is moored.

What has been the impact of Transportadora Callao over the mineral export process?

Before, there was a lot of traffic, which we have eliminated. We have also eliminated the previously recurrent theft problem. Before, concentrates were handled in open air, while ours is a closed facility. It is an automated system that increases speed by five times if compared to the previous one. Being a terminal exclusively dedicated to minerals, we do not compete with other cargo, so we have eliminated the 8-day average wait we had, and as a result, the client does not have to pay the ship for that wait. Before, you loaded a 20,000 metric ton ship in five days and today it takes you one day, because the system is much more predictable. Here we can accommodate boats from 9,000 mt to 60,000 mt. The average today is 20,000 mt.

José Antonio Valle

Managing Director LATAM
MIQ LOGISTICS



How was MIQ Logistics formed?

We are an American company, previously known as YRC Logistics. In Latin America, I started the Peru operation in 2004 with 14 employees. Today, we are present in six countries, with 350 employees and revenues close to \$100 million. The business is mainly focused on the support to the clients' supply chains in the mining, oil and gas and energy industries. However, with the crisis of 2008-09, mining companies overreacted and stopped all their projects, which prompted us to diversify. Today, 60% of our revenue comes from mining, oil and gas and energy, while the remaining 40% comes from the consumer industry, with clients such as Coca Cola and Mondelez.

What are the main logistics challenges in multi-billion capital projects?

Every project is different and requires tailor-made solutions. At a mining project, the speed is limited by the volume of the cargo and the delivery schedule. Therefore, planning is key, especially when it comes to oversized cargo. In Toromocho, for instance, we had to break the mills into different pieces due to the limitations of the Central Highway. Then, you need to consider the economic and social impacts. Shutting down the Central Highway, which is the main access route for the food that is consumed in Lima every day, you need to thoroughly study the different time windows you can use to move your cargo around. Then, you need to take care of all the people that have to wait in traffic, giving away newspapers, food, drinks and even ice cream in hot weather. Some people may claim that starting working on a project two years before is going to be more expensive, but it is not. If you do not plan things right and you have communities blocking a project for a week or a month, it is going to be much more expensive. At the expansion of Cerro Verde, another project where we participated, the mills for the expansion were bigger than the ones in Toromocho, yet they could be moved in one piece from the port of Matarani thanks to the better road infrastructure. And, if you look at a project like the southern gas pipeline, things move much faster. The pipes are unloaded very quickly and the transport chain needs to be very sharp. Every project is a different animal.

Carlos Roldán

General Manager
STIGLICH



How is the integration of the company within the Ultramar Group going?

The company was originally founded by the Stiglich family and five years ago, it was sold to the Ultramar Group. The group has several businesses in land and marine logistics, with companies in more than 16 countries. In Peru they own Stiglich and Grúas Alquileres, as well as two other companies related to marine logistics.

What are the main trends in the business right now?

We are specialized in oversized and heavy cargo. Over the years, we have had two business targets: business associated to capital expenditures (*capex*), which was the main focus, and services related to operational expenditures (*opex*), such as the transportation of mining tyres, concentrates and dangerous materials like cyanide, chlorine and mercury. Now, as the *capex* business is low, we are focusing more on

the areas related to *opex*. Before, the *capex* projects were so intense that we did not have resources to focus on the operational side. Up to last year, we had significant investment projects: we worked in Las Bambas and in the expansion of Cerro Verde. Right now, there are not that many projects. We have won contracts for the expansion of Toromocho, while we are bidding contracts for the expansions of Toquepala and Cuajone and the modernization of the Talara refinery. *Opex*-wise, we have regular services with some of the mines. There are many complementary services we could provide to mining companies, but we are a bit limited because many of these services would require storage space we currently do not have. One of the plans for this year is to move to a facility where we have that space, so that we can offer integrated logistics services, which is one of the specialties of the Ultramar Group. In Chile, for instance, we play an important role handling Codelco's logistics.

How do you tackle safety issues in road transportation?

Safety is one of the key elements for Stiglich. We have six people exclusively dedicated to our QHSE policies and strategies. We have the ISO certification and we follow the BASC protocols. In this context, when we work on investment projects we have safety staff permanently working on site. We have periodical reviews at the management level to detect any potential risky situations. We move extra-large cargo, and that always implies some risk.

Mining Safety

A mix of new technologies, better processes and a safety culture

The Peruvian Ministry of Energy and Mines' official spreadsheets on fatal accidents have two tabs. One looks at the total number of deaths and breaks that figure down into accident types, aseptically. The other one is tougher to digest: it lists all accidents one by one, including all the 'Ws': who, when, where, why? The 'what?' is always the same: someone, with name and surname, lost his life.

Macro statistics are very useful to identify the areas of focus for further improvements in safety standards. For instance, rockfall is historically the biggest source of fatalities by far, so companies know that more efforts are needed to mitigate the risks associated to underground operations.

However, not forgetting what the numbers hide (real people who left devastated families behind) is essential to continue improving safety statistics. Perhaps the key word is 'awareness'. Technology and processes have made great progress over the years, but any new worker that joins the mining sector needs comprehensive induction on safety, often from scratch. Without the proper leadership and safety culture, strict safety procedures can be less effective than initially thought. "An external consultant will not necessarily improve safety trends. What matters is the working culture, the leadership, and the ownership of safety issues," said Marcus de Monzarz, country manager at Sandvik. "At the end of the day, it is the worker who takes the decision about an action being safe or not." Ignacio Bustamante, CEO of Hochschild Mining, added: "The problem to solving



Image: Consorcio Minero Horizonte

safety issues is that in Peru it is very difficult to create a safety culture. People tend to think that someone else will take care of them, so they typically do not question the commands they receive from their superiors."

28 people died last year in Peru's mining sector, as opposed to 32 in 2014 and 47 in 2013. This figure includes traffic accidents by people going to work or getting out of work (for benchmarking, in other countries like Chile traffic accidents are not included as mining fatalities).

Over the first quarter of 2016, 8 people have already lost their lives in Peru's mining industry. Projecting that number over four quarters, we would be at the same levels of 2015; yet, the first three months of the year are traditionally the ones that concentrate the highest number of fatal accidents, so, with the increased effort by the industry and all the workers, we should hope for the best over the rest of the year. Stakeholders should not rest until the figure is zero. —

“

We are driven to safety excellence by focusing on behavior-based training to minimize unsafe acts and conditions in our different workplaces. From a technological point of view, we are rolling out a plan to automate our drill rigs and thereby reduce, and even eliminate, the contact between man and machine.



- Gary Sheppard,
COO,
Master Drilling

”

Fernando Borja

Manager

INSTITUTE OF MINING SAFETY (ISEM)



How do you read 2015's mining safety statistics in Peru?

There was a reduction of fatal accidents from 32 to 28 the year before. Since 2010, when there were 68 deaths, the improvement has been more significant. Since we have records of this figure dating back to the 1970s, we can say this is the first time that we have had less than 30 fatalities. As long as a single life is lost, there is a lot of work to be done, but it is good to see that fatalities are decreasing on an annual basis. The improvement is not only seen in the absolute numbers, but also in the ratio of deaths per 10,000 workers.

What factors help explain this trend?

Leadership plays a key role. Today, most general managers, if not all, understand that safety is the key priority in any operation. We have reached some level of maturity in the implementation of the safety systems. Some companies, like Gold Fields or Minsur, have consistently had great safety records. Others, like Volcan,

have dramatically improved their statistics. Besides leadership, other factors that have contributed to the reduction in the number of accidents are the safety culture among workers, their training and the modernization of mining techniques, especially in underground mining.

What were the main causes of deaths in 2015?

Accidents caused by rock fall continue to be the most frequent ones, while traffic accidents decreased significantly in 2015. The third cause of death is people falling, which had been a minor source of deaths in the last four to five years. It is an accident that can be easily prevented with protection systems, so it was surprising to see it rising again in 2015.

In terms of health, what are the main areas that could be improved?

Traditionally, the main occupational illness in the mining industry has been hearing impairment and deafness. Yet in recent years, lumbago has taken over as the main problem, typically as a result of lifting too much weight. The maximum a person can lift safely is 25 kilograms, but often we believe we are stronger than we actually are, especially as we grow older. With regard to deafness, the answer is in the better engineering and design of the equipment, and the utilization of ear-protection gear. Miners are also exposed to dust, so silicosis has traditionally been another health problem, but the situation has improved with ventilation systems and respiratory-protection systems. —

Noelia Rubio

Country Manager Peru
VERTISUB GROUP



How did Vertisub arrive in Peru?

Vertisub started 26 years ago in Spain out of a passion from people that love climbing, diving, speleology and other activities of this nature. The founders saw an opportunity to work in the industry of vertical jobs, in areas such as power, petrochemicals, cement and similar industrial segments. Most companies look at safety through compliance with the regulations and the paperwork required. We, however, focus on the worker, who is the person at risk. Today, Vertisub is present in Spain, the UK, Romania, Chile, Colombia and Peru. In total, we have carried out projects in 16 countries, also including Egypt, Bolivia and Canada. Right now we have 450 workers in total.

What has been your presence in Peruvian projects so far?

Our project in La Pampilla for Repsol is probably our most emblematic job in Peru so far. The refinery is stopping operations in two units for scheduled maintenance, and we have been hired to provide our elite industrial rescue group (GRI), and to coordinate the different jobs at height using our ATLAS system (Tactical and Logistical Support Applied to Safety).

We also have a project with Cementos Lima in Villa María del Triunfo, where we undertook non-destructive testing and we took off several tons of concrete of their silos. Other clients in Peru include Edegel, Pluspetrol, Backus, Cogorno, Cobra, Ajeper, Votorantim Metais and Abantia. In other countries, we already have experience in the mining sector. In Spain, we have been working for years for Iberpotash' mine near Barcelona. Our name, Vertisub, means that we can do projects at height or in underground or confined conditions, a segment where we are increasingly incorporating robotics and new technologies.

How important is the training part of the business?

We believe in training as the basic principle for safety. In this respect, our training centers ('CERM') are a key pillar in our business. We already have six of those and a seventh one under construction. In Chile we have trained 15,000 people already. In Colombia, over 6,000 people. In Peru we have already trained 800 people, even if we have only opened our CERM in May 2016. This gives an idea of the enormous demand for this type of training in the market. —

Augusto Tokumura

Commercial Manager Mining,
Oil and Gas
3M



What are the latest trends in terms of your mining offering?

2012 and 2013 saw the highest levels of mining investment, but now the priorities have changed. Today, what miners want is higher productivity and lower costs. Our latest products and services have been focused on meeting that need. For instance, over the last years one of our key products has been a kit to repair conveyor belts. Our products also achieve significant cost reductions in filtration. Having said this, our flagship product line in mining is safety. We are the leader in many segments of the safety business, including respiratory protection and ear protection. 80% of the mining companies countrywide use 3M respiratory protectors.

Your product portfolio is enormous. What is the challenge of maximizing market penetration in every line?

The fact that we are so diversified is one of 3M's key strengths but is also an obstacle from an operational perspective, because clients

may see us as a complex supplier. One of the goals of creating a specific mining market within 3M is to actually have one leader dealing with all the clients, and then this leader can count on the support of the different technology and commercial specialists. We have made lots of progress: before, people would mainly perceive us as a safety products provider, and now we are known in abrasives, filtration and electrical protection as well.

What trends do you see in the relationship of suppliers with mining companies?

We increasingly see that companies traditionally oriented to investment projects are moving towards services. For instance, companies selling filters are now offering maintenance services to even operate the whole filtration plant of a mining company. In our case, however, in most of the products we participate in, we mostly sell consumables, not pieces of equipment, so they do not require after-market service; the service we offer, in terms of consultancy or training, is related to the inherent 3M added value.

How are the mining sector and other industries raising the bar in safety?

The safety regulation for the mining industry has been in place for quite a long time now. Over the years, this has helped improve safety standards. What we are seeing now is that other sectors, such as construction or oil and gas, are starting to adopt these high safety standards that the mining industry had implemented years ago. —

Alberto Pazos

General Manager
DSI PERÚ



What has been DSI's evolution in the region?

DSI is a specialized provider of solutions for ground support. We are very well positioned in the mining sector, while we also have a strong participation in the construction segment. We have offices in 95 countries. We entered the Peruvian market in 2009, and our main goal is to become a strategic partner for the underground mining operator. Lately, the price of steel has gone down dramatically, and that has caused our revenues to decrease in the same proportion. To offset that trend, we are trying to sell more products. The great advantage we have is that our products are used in the operation of the mine and, therefore, there is a constant demand for them.

Having a global presence, what expertise can you bring to Peruvian mines?

DSI has a strong market participation in countries like Canada or South Africa, for instance, which have very deep mines and

present very difficult working environments. In these countries we offer a wide range of products and technologies, but some of them may not be known in Peru. We have to work very hard to convince local miners about a technology that may be proven somewhere else but not in Peru.

As an example, we have a technology called BullFlex, which is a textile column that is filled with cement to create a supporting pillar, and this replaces old support systems, for instance wooden structures, which are more expensive. Also, in the past, miners used to build walls to shut accesses and ramps, which would take three to five days, now with these pillars you have a more efficient solution. We are introducing this technology to the Peruvian market, and we believe that it will become widespread in the medium term.

What are your main products in Peru right now?

The cable bolt is giving good results to many clients, like Milpo, Glencore or Minsur. Our flagship product in the country is the friction bolt, also known as the split set. Other items that sell very well are the helical bar, the resins, the steel fiber for shotcrete production, and the support systems for permanent tunnels such as road tunnels and hydropower plants. We have products from different locations like Austria, the United States, Canada, China, Korea, Mexico and Brazil. In our Peruvian plant we have two production lines: split sets and cable bolts. We are the main local supplier of cable bolts. —

8 – 10
NOVEMBER
2016

SIM
SENEGAL 2016

HOTEL KING FAHD PALACE
DAKAR, SENEGAL

**4TH SENEGAL INTERNATIONAL
MINING CONFERENCE & EXHIBITION**

"The mining sector, a lever for territorial development"

www.simsenegal.com

MAURITANIDES
2016

11 – 13 October 2016
Centre International
des Conférences,
Nouakchott
Islamic Republic of Mauritania

**4th Mauritanian Mining, Oil and Gas
Conference & Exhibition**

Main Theme:
**"Diversifying Mauritania's
natural resource portfolio"**

www.mauritanides-mr.com

company / institution	page(s)	company / institution	page(s)
3M	138	Eaton	105, 107
AAP	97	Edegel	69, 137
AASHTO	77	EDM	118
Abantia	137	EFNARC	82
ABB	108, 131	Eloro Resources	48, 49
Aceros Arequipa	101	Emerson	105, 108
Adecco	129, 131	Engie	69
AESA	82	EPCM Experts	64, 65
Ajeper	137	ERM	70
AK Drilling International	116, 117	Esco	93, 95
Alva Hart Consultores	16, 17	Escondida	66, 70
Andean American	47	Esmetal	76, 78, 79
Anglo American	9, 101	Estudio Echecopar	127
Antamina	26, 30, 65, 66, 68, 69, 72, 77, 95, 101, 107, 125	Explomin	45, 116, 118
Apple	39	Exsa	123, 124, 126
AQM Copper	51, 52	Fargoline	87
Armco Steel Corporation	101	Ferreycorp	12, 43, 86, 87
Aruntani	26	Ferreyros	87
Asociación Pataz	25	Fiansa	87
Atlas Copco	89, 91, 93, 98, 100	First Quantum Minerals	9, 42, 53
Austin Engineering	93, 94	FLSmith	33, 110, 112
AVIS	129, 130	Fluor	64
Backus	137	Focus Ventures	11, 55, 56
Banco Central de Reserva (Peru's Central Bank)	8, 44	Forbis	87
Barrick	20, 21, 22, 26, 48, 49, 77, 107, 131	Fortuna Silver	26, 81, 83
Bear Creek Mining	15, 50, 51	Fosfatos del Pacifico	55, 57
Bechtel	64, 79	Freyssinet Tierra Armada	77, 80
BHP Billiton	67, 72, 73	García Sayán Abogados	19
Boart Longyear	44, 92	Geotec	114, 116, 118
Bosch Rexroth	95	Geovita	75, 81
Boytec	119	Gerenpro	66
Breca	39	Gerens	11, 105
Brocal	26, 66, 134	Glencore - Antapaccay	17, 26, 30, 34, 88, 93, 94, 95, 102, 107, 116, 119, 126, 138
Buenaventura	10, 16, 26, 44	Gold Fields	12, 20, 21, 26, 68, 77, 101, 123, 137
Buenaventura Ingenieros (BISA)	59, 60, 61, 64	Golder Associates	67, 68, 70
Canada Peru Chamber of Commerce	55	Graña y Montero	74, 77
Caravelí	26	Grúas Alquileres	135
Casapalca	26	GSI	101
Caterpillar	86, 87, 89, 95	GST	101
Cementos Lima	137	GWI	112
Cementos Pacasmayo	55, 57	Halliburton	119
Cerro Verde /	3, 8, 10, 12, 15, 16, 26, 30, 31, 77, 78, 79, 80, 88,	Hatch	60, 61, 62
Freeport McMoRan	95, 101, 107, 108, 124, 125, 131, 134, 135	Hermes	128
Certimin	115, 120, 121	Hitachi	86, 94, 95
Champion Iron Mines	49	Hochschild Mining	21, 26, 28, 47, 63, 65, 69, 136
China Minmetals	9	HP	130
Chinalco - Toromocho	10, 17, 30, 40, 79, 88, 102, 124, 131, 133, 134, 135	Hudbay Minerals - Constancia	6, 10, 26, 30, 34, 51, 74, 77, 88, 102, 123, 132, 133, 134
Cisco	39	HV Contratistas	71, 75, 81
Cobra	132, 137	Iberpotash	137
Coca Cola	135	Impala	134
Codelco	72, 73, 112	Inca One Gold	45
COFIDE	101	Instituto de Ingenieros de Minas del Perú (IIMP)	63, 76, 142
Cogorno	137	Intel	26
Coimolache	26	International Finance Corporation (IFC)	54
Colquisiri	26	International Labour Organization (ILO)	16, 17
Comarsa	26	International Monetary Fund (IMF)	8, 9
CONCYTEC	10, 63	ISEM	39, 137, 142
Consorcio Minero Horizonte	21, 24, 26, 128	JLG	79
Contacto	127	Joy Global	33, 86, 89, 90, 93, 95, 98, 100
Cooper	107	JRI	66, 67, 70
Cresko	87	Kallpa	69
Cummins	88	Kitco	35
Defensoría del Pueblo (Ombudsman Office)	14	Klohn Crippen Berger	69, 70
Dell	130	Komatsu	86, 88, 89, 94, 95, 98
Divemotor	96	Komatsu Mitsui Maquinarias Perú	84, 85, 88, 89
Doe Run	26, 66	Lake Shore Gold	20, 23
Dreyfuss	134	Larox	104
DSI	138	Layher	76, 78
DuPont	124		
Dynacor Gold	45, 46, 132		

company / institution	page(s)	company / institution	page(s)
Layne Christensen	119	Rio Tinto	9
Letourneau	98	Robocon	81, 82
Liebherr	86, 89, 90, 94, 95	SalfaCorp	75, 81
Lindley	66	Samarco	67, 68, 69
Lupaka Gold	47, 48	San Martín Contratistas	77
Lurgi Metallurgie	104	Sandvik	92, 98, 100, 136
Maccaferri	77, 80	Scaw Metals	101
Mack	97	SCM	83
Maestranza Diesel	95	SDLG	97
Martin Engineering	103	Sedapal	68
Master Drilling	136	Senace	17
MCAP	57	Sentient	54
Mega Representaciones	87	SGS	120, 122
Mepsa	101	Shougang	26, 107
Mercedes-Benz	96	Siemens	13, 105, 107, 132, 133
Metso	33	Sierra Metals	26, 36, 40
Milpo	9, 26, 36, 38, 50, 63, 66, 81, 83, 92, 98, 107, 138	SIMSA	26
Minera IRL	26	Sitech	87
Minera Titán	26	SNL Metals & Mining	44
Mining Plus	65	SNMPE	7, 10, 12, 142
Ministry of Energy and Mines (MEM)	16, 35, 37, 136	Sodexo	128
Minsur	16, 26, 36, 39, 54, 63, 65, 66, 68, 81, 83, 137, 138	Soletanche Bachy	77
MIQ Logistics	133, 135	Sony	39
Mitsubishi	55, 57	Southern Copper	26, 30, 44, 66, 79, 80, 88, 94, 107, 108, 124, 125, 135
Mitsui	26, 88	Southern Legacy Minerals	53
MMG Las Bambas	8, 18, 26, 30, 32, 58, 72, 77, 78, 79, 80, 88, 94, 101, 107, 118, 124, 126, 133, 134	Southern Peaks Mining	26, 36, 37, 41
Modular	88	SRK Consulting	61, 63, 70
Moly-Cop	101, 102, 103	Stantec	61
Mondelez	135	Stiglich	135
Montabert	90, 98, 100	STRACON GyM	23, 67, 71, 73, 74, 80, 81
Mosaic	26	Sulliden Gold	23
Motored	87	Sunafil	17
MRG	108	SVS Ingenieros	61
MTI	90, 98	Taboca Mineração	39
MWH	61, 68, 69	Tahoe Resources	2, 20, 23, 26, 48, 49, 121, 123
Newmont Mining	26	TDM	80
Normet	98, 99	Teck	41
Nyrstar	26	Thyssenkrupp	103, 131
Odebrecht Energía	69	Tinka Resources	44, 51, 54
OHL	72, 73, 133	Trafigura	26, 41
Orica	125, 126	Tramarsa	134
Orvisa	87	Transportadora Callao	134
Ositrán	134	Trapano	119
Osterling Abogados	127	Trevali Mining	26
Outokumpu	104	Trex	87
Outotec	103, 104	TUMI Raise Boring	29, 80, 81, 83
Pan American Silver	26, 29, 41, 81, 82, 83, 130	TÜV Rheinland	72
Pandion Mine Finance	47	Ultramar	135
PDAC	72	Unimaq	87
Peróxidos do Brasil	111	Vale	26, 55, 57, 67
Peru Copper	17	Vamsac	108
Perubar	134	Veolia	70, 110, 112
PeruRail	133, 134	Vertisub	137
Petroperú	78	Viceversa Consulting	17
Pluspetrol	108, 137	VINCI	77
Poderosa	21, 25, 60, 63	Vivargo	79, 80
Polysius	33	Volcan	26, 69, 82, 107, 137
PPX Mining	48	Volvo	96, 97
Quimtia	110, 111	Votorantim	36, 69, 91, 137
Quiruvilca	26, 36, 41	Watermark	113
Raura	26	Waze	88, 89
Red Eagle	74	Westinghouse	107
Regulus Resources	51, 53	Whittle Consulting	61
Repsol	137	Willis Towers Watson	127
Resemin	98, 100	World Economic Forum	62
Retamas	26	Xstrata	11, 17, 77, 94
Rio Alto Mining	20, 23	Xylem	110, 113
		Yanacocha	26, 64, 82, 95, 101, 107, 108, 123
		Zanja	26
		Zuari	57

EDITORIAL AND MANAGEMENT TEAM

Senior Project Director: Alfonso Tejerina (alfonso@gbreports.com)
Project Director: Laura Brangwin (lbrangwin@gbreports.com)
Project Coordinator: Katherina Prügel

Executive Editor: Mungo Smith (mungo@gbreports.com)
Operations Director: Miguel Pérez-Solero (mperezsolero@gbreports.com)
Graphic Design: Designa (gdc@gopadesign.com)
Graphic designers (ads): Özgür & Deniz (ozgur@gbreports.com)
General Manager: Katya Koryakovtseva (katya@gbreports.com)

Your opinion is important to us,
please be in touch to share your comments on this report!

For updated industry news from our on-the-ground teams around the world,
please visit our website at gbreports.com, subscribe to our newsletter through our website,
or follow us on Twitter: @GBReports.

THANK YOU

We would like to thank all the executives and authorities
that took the time to meet with us.
Also, special thanks to:

PERUVIAN INSTITUTE OF MINING ENGINEERS (IIMP)
iimp.org.pe

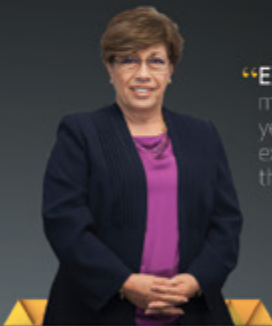
NATIONAL SOCIETY OF MINING, PETROLEUM AND ENERGY (SNMPE)
snmpe.org.pe

INSTITUTE OF MINING SAFETY
isem.org.pe



Join us at the **Largest International Mining Trade show of 2016**

The largest mining investment
in peru's history from 2016:
63,115 billion dollars



“EXPOMINA PERU 2016 , will be the most important mining exhibition of the year with the participation of top executives and leading professionals of the mining sector.”

Eva Arias de Sologuren
President of EXPOMINA PERU 2016
Chairman & CEO of
Compañía Minera Poderosa



“In 2014 I had the honor of presiding over EXPOMINA PERU fifth edition, the largest mining suppliers' exhibition in Lima that generated over 500 million dollars in business transactions. It should be noted the high level of the conferences in charge of renowned speakers that contributed to the exhibition success.”

Roque Benavides
Chairman & CEO
Compañía de Minas Buenaventura



“EXPOMINA PERU 2016 is definitely the best opportunity for mining suppliers to grow their business and to establish and strengthen business relationships. Come and join us at the largest mining exhibition in Lima!”

Jorge León Benavides
Chairman & CEO
Grupo Digamma

45,000 m² of exhibition area **15,000** buyers invited **100,000** visitors **Key Note Speeches** by renowned speakers

www.expominaperu.com

Gold Sponsor:



Silver Sponsor:



Media Sponsor:



Cooper Sponsor:



Magazine Sponsor:



Organized by:





GLOBAL BUSINESS REPORTS