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GBR GLOBAL BUSINESS REPORTS

Peru's mining industry

In Need of a Jump-Start

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Cerro Verde has invested $5.6 billion to expand copper production: $4.6 billion to add extra capacity of 240,000 mt/d to its concentrator, and $1 billion to build a new leach pad and improve the existing concentrator and SX/EW facilities, among others. Photo courtesy of Freeport-McMoRan.

A REPORT BY GBR FOR E&MJ

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Introduction

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

Peru will produce more than 2 million metric tons of copper this year. Image: Toromocho concentrator, courtesy of Chinalco.

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.

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 industry has done well, but could have done so much better.

Ernesto Balarezo, vice-president for the Americas at Gold Fields, laments that no new project has been 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.

Carlos Gálvez, president, SNMPE.

Mariela García de Fabbri, CEO, Ferreycorp.

New Leader in Precious Metals

Tahoe operates La Arena and Shahuindo Gold Mines in Peru

Production

- ✓ Low-risk operation
- ✓ 2015 production of 230,436 oz Au

Construction

- ✓ **Shahuindo** Gold Mine Phase 1 construction completed in 2015
- ✓ Commercial production expected in Q2 2016
- ✓ P&P Mineral Reserves increased by 86% and exploration continues

Exploration

- ✓ **Peru**: ~55,800 hectares in a highly prospective region
- ✓ **El Alizar:** in close proximity to La Arena
- ✓ **Shahuindo**: Recon drilling to identify outside targets

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Mining Production

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

Las Bambas reached commercial production in July 2016. Photo courtesy of Austin Engineering.

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 last year, 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 this year should be 410,000 to 450,000 oz, 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 last year, gold reserves have increased 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.

"PMR production should be around 240,000 oz of gold per year for the first five years which, although smaller than the oxides production, is still significant and opens the door to unlock other potential refractory ore sources in the surroundings. It would be the first autoclave plant in Peru," Fumagalli said.

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 last year, and Shahuindo, a project in Cajamarca that will be reaching commercial production this year.

Tahoe's VP of operations Tim Williams commented on 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."

Tim Williams, VP operations, Tahoe Resources.

With regard to La Arena, the operation is currently exploiting the gold oxides where mineral reserves were still 919,000 oz as of the beginning of this year (taking the company through to 2021). Tahoe is working to expand gold resources there, while there is also the copper resource underneath: "At La Arena 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 0.33% Cu and 0.24 g/mt Au (M&I). Current copper prices are a bit low for us but we continue working on the engineering to define a possible copper mining operation. Combining our gold oxide and the copper-gold sulfide reserves, there is potential for us to have a continuous presence in Peru for the next 20 years," emphasized Williams.

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 efficiency. While the main sources of capital expenditure are the tailings dam and the waste storage deposits, Ernesto Balarezo, executive VP for the Americas at Gold Fields, insists 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 of silver equivalent were $21.70/oz. Last year it was just $12.90/oz, 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.

This effort is not over; after abandoning the processing of ores that were not profitable, the company has 2,700 mt/d of spare capacity between its Pallancata, Arcata and Ares plants. “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,” said Ignacio Bustamante, Hochschild’s CEO.

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.

José de los Heros, general manager of Horizonte, outlined the company’s strategic plans for Parcoy: “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 $50-million project to build a 1,090-meter, 5-station shaft. This will not only reduce transportation costs for

Ignacio Bustamante, CEO, Hochschild Mining.

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. 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 to 30 years."

Meanwhile, output from Poderosa was 190,000 oz of gold last year (+22%), and estimates for this year 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."

Large copper projects

In the years between 2005 and 2014, yearly copper production only increased by 370,000 mt/y. Last year (2015), however, was the start of a big transformation. Production increased by 321,000 mt/y to reach 1.7 million mt/y. This year, the forecast is to reach more than 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 have stolen most of the headlines 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 will start making a big difference. 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 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."

Harry 'Red' Conger, president & COO Americas and Africa Mining, Freeport-McMoRan.

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 (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."

Base metals

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.

On top of the steps undertaken to integrate the two mines' infrastructure, the company is also looking for additional ore in the vicinity. It is already exploiting a small-scale open pit called San Gerardo, and it plans to put the nearby Shalipayco project into production as well, according to Víctor Gobitz, CEO of Milpo: "Shalipayco is just 60 km from our Pasco complex and could be in production very soon. 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 would save us the capital investment of expanding our El Porvenir plant."

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," Gobitz said.

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, ferroniobium and ferro-tantalum. Besides this, it


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Víctor Gobitz, CEO, Milpo.


Juan Luis Kruger, CEO, Minsur.


Adolfo Vera, CEO, Southern Peaks Mining.

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. "After realizing that the underground option was not viable, we are now looking at an open pit model for Mina Justa," said Juan Luis Kruger, CEO of Minsur. "The mine should yield between 100,000 and 120,000 mt/y of fine copper. We are 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."

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. "Production is 20,000 mt/y, and we have reserves and resources for nine more years," said Kruger. "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."

Modernizing underground mines

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 Ari-

Shahuindo is Tahoe Resources' second gold operation in Peru and is already processing 10,000 mt/d. Photo courtesy of STRACON GyM.

ana, a development project. "In April we received the approval of our EIA for Ariana, and this is a key milestone. It 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/lb Cu, 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," said Adolfo Vera, CEO of Southern Peaks Mining.

Vera also 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 ton immediately. As a result of mechanization, we have also reduced the workforce, reducing safety risks and ensuring that we can be a good employer for the people we have."

Vera explained that the company is looking at cheap ways to expand plant capacity, because with increased efficiency they should be able to produce more ore. "One of the challenges we have at Condestable is that the rock is very hard. We are finalizing talks with a German company that produces very special mills for the cement industry. The material at Condestable is very dry and is amenable to this kind of milling," Vera explained.

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.

Sierra Metals' president & CEO, Mark Brennan, detailed his company's efforts at Yauricocha: "We have gone from 100% steel set advancement to 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."

Besides Yauricocha, Sierra Metals also operates the Bolívar and Cusi mines in Mexico. In Peru, beyond modernization, the company expects the new Esperanza discovery to play an important growth role moving forward. Brennan says it has the potential to be very large and is amenable to production very quickly, being only 400 meters from the central mining area at Yauricocha.

While Sierra Metals expects to grow through brownfield exploration in Peru and Mexico, Compañía Minera Quiruvilca wants to use the mining experience acquired over the last months to identify other assets in the region.

Community Relations

New project development cannot happen without the social license

The importance of having happy neighbors: mining companies promote the creation of sustainable businesses in their area of influence. Photo courtesy of Bear Creek Mining.

The issue of social conflicts related to the mining sector is nothing new. Indeed, there are many disputes that people in Lima never hear of, unless violence and clashes erupt. According to Peru's Ombudsman Office, 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 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.

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.

Elsiario 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 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. 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 says 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.

According to Bruce Clements, president of Cerro Verde, "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.

Bruce Clements, president, Cerro Verde.

Feeding the Project Pipeline

Project developers and explorers keep working despite market challenges

A lower copper price is raising questions over how many new deposits will be developed over the coming years. Photo: panoramic view of Haquira, courtesy of First Quantum Minerals.

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.

Cash through gold production

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 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.


Jean Martineau, president and CEO, Dynacor.

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."

Peruvian Precious Metals 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 Peruvian Precious Metals, 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."

Thomas Larsen, president & CEO, Eloro Resources.

Graham Carman, president & CEO, Tinka Resources.

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 capex, 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 La Libertad, 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."

Base metals exploration

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 a significant increase of zinc prices for years, but he points out that the trend is already positive in 2016. "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."

Tinka is backed by Australia's Sentient Group, owners of 21% of the company. Last year, the World Bank's IFC also joined as a shareholder. In terms of project ownership, Tinka has 100% of Ayawilca-Colquipucro, although there is a 1% royalty in place that the company can buy back for $1 million.

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 feasibility 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). Andrew Swarthout, president & CEO of Bear Creek, said: "We identified that we could use dry stack tailings from the start and then mix the tailings with waste materials as of year 6 of the operation to backfill the pits. This way you recover a lot more water, and you eliminate the need for a large tailings facil-

John Black, CEO, Regulus Resources.

ity, which requires a lot of sustaining capital to run. We did a trade off to save $30 to $40 million over the life of the project, although we had to increase our initial capex for the extra stripping and the filtration system required."

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%.

Bruce Turner, president & CEO of AQM Copper, said: "At today's copper price, the project is not viable, but at $3/lb Cu it is 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. Internal approval may take longer than under better market situations, but I will believe we will eventually move on to the next stage."

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 10 g/mt silver.

John Black, CEO of Regulus, expects to replicate at AntaKori the success of the sale of the Haquira project to First Quantum Minerals in 2010. He explained that mineralization at Antakori is open in all directions except up: "This inferred resource is based on only 17,000 meters of historic drilling, so the size of this project will most likely increase substantially with further work. We are probably looking at a three to five year drilling campaign with 80,000 to 100,000 meters of drill core to identify how big the deposit is."

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," Black said.

Phosphate potential

Finally, 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-feasibility study for its Bayóvar 12 phosphate project, where it plans to produce direct application phosphate rock fertilizer (DAPR), with grades of 24% and 28% P_2O_5. 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."

Engineering and Construction

Consultants and contractors focus on opex-related projects

Photo courtesy of C.M.Horizonte.

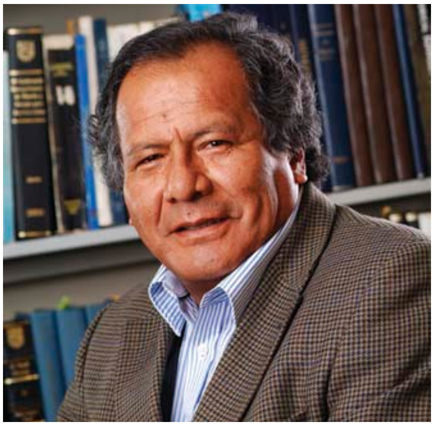
Companies dedicated to the development of mining projects in Peru have faced a very particular situation this year. On one side, low metal prices have discouraged new investment decisions in the mining industry. On the other, the general election has left in a limbo those projects that were paralyzed by social issues, such as Conga and Tía María, at the same time that public spending in infrastructure projects 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 for BISA: we can become the

Mario Marchese, general manager, Hatch.



Antonio Samaniego, director, SRK Consulting.

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 optimization projects are smaller in nature, consultancy companies need to rely on a larger number of shorter projects to maintain healthy levels of cash flow. Also, work does not naturally arrive on the consultants' desk as before, emphasized Alberto Coya, general manager of MWH: "During the boom years, 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."

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 with 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."

Construction services

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


Ricardo Vega, president, OHL.


Steve Dixon, CEO, STRACON GyM.


Marc Blattner, general manager, TUMI.

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 contracts. 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.

Underground opportunities

STRACON GyM has mining contracts with Tahoe Resources for both La Arena and Shahuindo, while it has been doing extensive work for First Quantum's Cobre Panama project and Hudbay Minerals' Constancia. Traditionally an earthmoving and open-pit mining contractor, STRACON GyM wants to increasingly look at underground activities, like the aforementioned San Ramón mine by Red Eagle. "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 and we want to position ourselves in this segment for the future," said Dixon.

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 Ferreccio del Río.

Peru does not have very large underground mines like El Teniente in Chile, however some players are already producing volumes that are not negligible. Milpo's Cerro Lindo, for instance, will be pro-


Enrique Sattler, general manager, Robocon.


María Eugenia Parot, VP Latin America, Golder.


Juan Rayo, CEO, JRI.

cessing 20,000 mt/d by the end of this year. Juan Rayo, CEO of JRI, a Chilean engineering consultancy with a long history working in Peruvian projects, said: "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."

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. Robocon works in Peru in different mining operations run by Volcan and Pan American Silver and has recently entered the gold segment in alliance with local contractor AESA for exploration tunnels at Yanacocha. 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. "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," added Sattler.

Another example of innovation in underground operations is provided by TUMI, a Peruvian company affiliated to Stu Blattner in the U.S. The company is 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, in partnership with a Chilean company.

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: "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," Blattner said.

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 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 sizes, but the Chilean market does. The needs at El Teniente match perfectly the capabilities of the SBM 700 SR," concluded Blattner.

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, most 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.

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.

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.

Photo courtesy of C.M.Horizonte.

Mining Services

Providers increase their value proposition

The last couple of years have not been easy for the companies serving the mining industry. Overall, they have had to give more for less, and this process is not over yet.

Things often happen for a reason, though; during the boom years, the industry paid salaries that were unheard of not long before, which inflated costs along the value chain. As the industry is reaching a new point of equilibrium, those companies that have adapted their cost structures and that are not hostage to large debts can look at the future with bright eyes.

The exploration segment is where it all starts and it has been the first victim of the low cycle. While operating mines have had to continue a good portion of their brownfield exploration efforts, generative exploration has been pretty much wiped out of the market, with a few exceptions.

Drilling

Geotec, a drilling contractor, only has 15 rigs operating today, out of a fleet of over 60. The company is working at La Granja, Yanacocha, Marcobre and Antapaccay. 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. Today, Geotec is able to compete in price with a small family drilling company. Our advantage in low periods like this is that, along with selecting the best equipment, we have also kept the best supervisors, drillers and technicians."

Peru's drilling market is estimated to be 1.2 million meters this year, which is less than half the amount in 2012. Market rates per meter are also far lower than four years ago. Out of the total 1.2 million meters, 60% comes from underground exploration, an area where Geotec has never been present. "We are losing out by not being present in underground mining. It is a significant market and we are evaluating entering the business this year, with a new technology that allows you to drill more rapidly and efficiently," 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, and it is currently working at 55% of its capacity. With a presence in five countries in the region, AK Drilling can move rigs around depending on market needs.

AK Drilling's general manager Jorge Granda lamented that companies always decide to cut exploration when the market offers great conditions to advance projects: "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 expanded on how technology is changing in the drilling business: "We are looking at investing in production and presplit machines. 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. 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."


Miguel Ángel Arenas, general manager, Geotec.


Jorge Granda, general manager, AK Drilling.


Noé Vilcas, general manager, Explomin.


Miguel Caillaux, director, Certimin.


José Luis Alván, VP minerals South America, SGS.


José Miguel Ríos, commercial lead, Orica.

Since big mining companies are doing most of the exploration as part of their brownfield campaigns, they are looking for established contractors that can invest heavily in training and new technologies. Small family-owned drilling companies are increasingly out of the market, as they cannot afford to comply with the clients' strict technology requirements, their safety induction periods effectively 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.

Explomin has recently acquired five rod feeders, as well as two rod handlers for reverse circulation rigs. Vilcas commented on these acquisitions: "Before, you would handle rods manually, which created exposure to the operator's hands and fingers. This new equipment prevents those risks. Each machine costs between $150,000 and $250,000, so these are strong investments that do not add direct value, because you are not going to drill more meters with them. However, they add indirect value, because they open doors with the world-class mining companies."

Laboratory tests

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."

R&D in blasting

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.

Gustavo Gómez Sánchez, general manager, Exsa.

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: 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."

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 operations including Cerro Verde, Las Bambas and Antapaccay. According to its commercial lead in Peru and Bolivia, José Miguel Ríos, 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.

In operations like Toromocho and Las Bambas, 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 Ríos.

According to Ríos, Orica has a market share of around 35% in bulk explosives and a 60% participation in initiation systems. The company is increasing its manufacturing footprint in Peru, as it is doubling capacity at its Congata emulsion explosive plant, near Arequipa, while it is also evaluating a $12 million investment in a new plant in Southern Peru.

Outsourcing services to specialists

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 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

Photo courtesy of Ferreyros.

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. This way, they can provide 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 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 handled all the facility management."

For the nature of these activities and the clients' push to promote local employment, this is an area of work where Adecco involves the local communities: "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. Once we have the thumbs up of the mining company, we go to the community and engage in the whole recruitment process, which includes the medical evaluations and the different induction programs," Llosa said.

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.