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A Healthy Industry Survives the Political Shake-ups

Despite ongoing scandal fueled by the Odebrecht saga, Peru's mining sector sees a fresh wave of investment

On April 17, 2019, Peruvian citizens were shocked by a disturbing piece of news as they were having breakfast or heading to work. Former president Alan García, who ran the country during two mandates (1985-1990 and 2006-2010), had shot himself as agents arrived at his home to put him in preliminary detention, in the context of a corruption investigation linking García with Brazilian construction firm Odebrecht. García was rushed to the hospital, but his death was confirmed later that morning.

García's death served as the dramatic climax to a series of events that saw Peru's last four past presidents all involved in the Lava Jato corruption scandal and accused of a variety of charges, from Alejandro Toledo (2001-2006) to Pedro Pablo Kuczynski ('PPK', 2016-2018). Indeed, current president Martín Vizcarra only became head of state because he was the vice-president when PPK decided to resign in March 2018.

Such levels of political and judicial turmoil are bound to have an impact on any country's economic well-being; indeed, these developments have seriously affected the construction segment and put to a halt a wide range of badly needed infrastructure projects in Peru. Yet there is always a silver lining: as political leaders across the spectrum fell into disgrace, the mining industry pushed ahead with significant projects, empowered by better commodity prices and a breaking point in the mining cycle.

2018 brought three significant pieces of good news to the industry in Peru: the US$1.3 billion expansion project at the Toromocho copper mine, operated by Chinalco; the start of construction of Mina Justa, a US$1.7 billion copper project; and the final green light by Anglo American to build the Quellaveco copper operation, a project with an estimated capex in excess of US$5 billion. On top of these ongoing investments, Chinese miner Shougang completed the expansion of its Marcona iron ore operation in mid-2018 as well.

To put these figures into perspective, total mining investment amounted to US$4.95 billion in 2018, according to the Ministry of Energy and Mines (MEM). This represents close to a 26% increase from the US$3.93 billion invested in 2017. While the expectation for 2019 is positive with official estimates reaching around US$6 billion, these amounts still lag behind the record investment figures of the super-cycle period between 2011 and 2015, when the annual average was around US$8.4 billion.

REALIZING THE COUNTRY'S POTENTIAL

While no one expects another super-cycle, an old theme persists: Peru could fare much better in terms of project development. Luis Rivera, president of the Peruvian Institute of Mining Engineers (IIMP), pointed at Peru's enormous geological potential: "Peru is a relatively large country with 1.3 million square km, but it is small if compared to continent countries like Canada, the United States or Australia; yet, Peru has all the metals that are important to the industry. What we do not have is political stability and that prevents the country from translating its potential into real investment. If Peru could develop projects like Tía María, for instance, we would have double the investors; we would be even more attractive than Canada," he assured.

In any case, the global mining market is moving. Peru doubled its copper production in just a decade between 2007 and 2016, positioning itself as the world's second largest producer after Chile, and the country continues to host a very promising pipeline of copper projects. Furthermore, major gold companies have entered a new wave of mergers and acquisitions, led by the Barrick-Randgold and the Newmont-Goldcorp consolidations. Peru is the sixth largest gold producer according to the United States Geological Survey (USGS, 2018 data), and has moved up to fifth place in terms of reserves so, again, the country's geology is not under question – Peru just needs to promote an environment that is business-friendly.

CREATING CLUSTERS

Looking at the future of copper production, Peru intends more multi-billion dollar investments to catch up with the red metal leader, Chile. Pablo de la Flor, executive director of the National Society of Mining, Petroleum and Energy (SNMPE), noted that Peru has a portfolio comprising of 48 projects worth US$60 billion in future investment, and half of these projects are in copper: "If you look at the main 20 copper producing mines in the world today, only four of them started in the 21st century. So, Peru has the potential to bring new capacity at very competitive costs, in a context where older mines are becoming more expensive," he said.

"Peru has all the important metals, but not political stability. If Peru could develop projects like Tía María, for instance, we would have double the investors; we would be even more attractive than Canada."

-Luis Rivera, President, IIMP

While Peru is probably a couple of decades behind in its mining development with respects to Chile, this can be seen as an opportunity: the country has the chance to start new mines with the latest technology to assure the lowest cost per pound of copper produced. Additionally, labor and power costs in Peru are more competitive than in Chile.

A main objective ahead is the creation of mining clusters, where providers can set up efficient service shops close to the mining operations and miners can share certain infrastructure. A move

Photo courtesy of AESA

in this direction has already been taking place in the Arequipa region as a result of the large copper production coming out of southern Peru. Luis Rivera, president of IIMP, elaborated on the factors underpinning this region's success: "There is already a natural mining cluster in Arequipa: Matarani is the largest port in the world for mineral concentrates, handling 6 million tonnes annually (mt/y), while the port of Mollendo is critical to receiving inputs for mining operations. Meanwhile, the pampas of Uchumayo, Majes and La Joya are transforming into industrial service hubs for the mining sector."

While there has been great progress in the south, there is room for more industry integration in the area with the development of the large Las Bambas copper district in Apurimac. Additionally, at the other end of the country in the north, some industry leaders see an opportunity to go one step further and have several large copper projects in the area share actual operations infrastructure: for instance, a tailings dam, processing plant or concentrate pipeline.

"In the north we have Michiquillay, Galeno, Conga, Yanacocha's sulphides, La Granja, Tantahuatay and Cerro Corona," explained Carlos Gálvez, former president of SNMPE and current president of the organizing committee of PERUMIN, the country's main mining conference and exhibition. "To develop all these projects, we cannot look at them as isolated endeavors; we need to consider the wider picture with an optimized plan, making the most of new technologies," he affirmed.

For this to happen, the State needs to play a key role in coordinating the different projects, developing the underlying infrastructure and collaborating with the industry on a sustainable development plan, bearing in mind that most mineral deposits in Peru are located in remote and economically underdeveloped districts.

Suresh Vadnagra, president of Minera Las Bambas, the country's third largest copper producer, gave his view on the matter, reflecting on his experience in the remote district of Apurimac where Las Bambas operates: "What needs to come first: The infrastructure that incentivizes the mining projects, or the mining projects that support the development of the infrastructure? It is a catch-22 situation. Whatever way we look at it, significant coordination between the various parties is required."

"Regions have only spent 66% of the money from canon and royalties over the last 10 years. Without better investment execution capacity, the roles of the State and the private segment will continue to be misunderstood."

-Manuel Fumagalli, President, SNMPE

WORKING THE POLITICAL AND SOCIAL ASPECTS

In Peru, the level of conflict between the mining industry and anti-mining activists has eased with respect to past confrontations, such as those that led to the paralyzation of the Conga project in Cajamarca and the Tía María project in Arequipa. Yet, while Quellaveco and Mina Justa have successfully moved into the construction stage, the aforementioned projects remain on stand-by. Southern Copper spokesmen regularly state their eagerness to put Tía María into production as soon as possible, but Newmont seems to have abandoned Conga until further notice.

Across Peru, the industry should be careful to build good relations with the new regional governors elected in October 2018, particularly in the Puno region, where Walter Aduviri was elected as governor. Back in 2011, Aduviri led violent protests that ended with six deaths, and he is now on trial for this case. Following this violence, Bear Creek Mining lost its concession for the Santa Ana project. Today, Bear Creek is still in Puno with another silver project, Corani, which is expected to move to the construction phase soon and will involve a capex of approximately US$585 million.

Puno is not the only region where tough questions about mining development are being raised. The new governor of Arequipa, Elmer Cáceres, has shown opposition to the Tía María copper project, and while the new governor of Cajamarca, Mesías Guevara, is not an outspoken opponent of mining like his predecessor Gregorio Santos, he is not likely to push ahead any mining projects that could raise controversy.

"Regional and local elections bring a new scenario, and companies need to rebuild their relationships," explained Oscar Díaz, CEO of Viceversa Consulting, a specialist firm in environmental and social services. Díaz advised mining companies to be more proactive in their communication efforts with political leaders: "Companies always wait for the results of the polls, but what they should do instead is work with the main candidates before the elections."

DEFINING THE AREA OF INFLUENCE

Getting a project to the stage where it has all necessary permits and a social license is a great amount of work, but it is just the start. Once the mine is in production, a whole new set of questions is generated in terms of how to design the social strategy

in the area of influence. Indeed, defining the area of influence itself is one of the first headaches for companies operating in remote areas, where state institutions are weak or non-existent. "There is a great deal of discussion about whom the mining company should work with: just with the direct area of influence, or if it should include the indirect area as well. There is no guideline for this and every project is different. The State should be the one mediating to help companies define their area of influence," explained Díaz of Viceversa.

A recent conflict around Las Bambas, one of Peru's main operations that represents 2% of the world's copper output, showcases how the interaction between the communities, the mining company and the State can go wrong. Allegedly following counsel from the Chávez Sotelo brothers, a duo of controversial lawyers investigated for extortion, local communities blocked the road used to truck the copper concentrates out of the mine for more than two months. The standstill put MMG, the mine's operator, on the verge of having to halt all mining activities on site. Finally, in April 2019, and only after negotiations with high-level participation from the government, the communities ended the blockade.

One reason given for the communities' protest was the State's non-fulfilment of several commitments related to the conversion of the local road used to transport the concentrates into a national highway. Yet, the communities had directed their ire at the mining company. Manuel Fumagalli, president of SNMPE, asked the national and regional governments to play a more proactive role in cases like these: "Adding the mining canon and the royalties, the regions have received 67 billion soles [PEN, US$20 billion at today's exchange rate] from the mining and energy industries over the last 10 years. However, on average, regions have only spent 66% of that. Without better investment execution capacity, the roles of the State and the private segment will continue to be misunderstood and the communities will address their demands to the private companies."

While the country needs stronger institutions to promote development, it seems clear that the industry cannot turn a blind eye to the problems of the population around its operations. Suresh Vadnagra, president of Minera Las Bambas, reflected on how the company wants to work with the new regional authorities in Apurimac: "It is important for us to understand their aspirations and learn how we can contribute towards their development goals for the region. One of the key challenges for Apurimac is the high rate of anemia, which is 54% in children under 36 months. The central and regional governments have a plan to eradicate anemia, and we are looking at programs to support this initiative," he said.

It is difficult to accept that, nearly three decades after modern mining development took off in Peru, the country's population continues to face severe development issues in the poorer areas. This must prompt both industry and government to continue working together so that the industry representing around two thirds of Peru's total exports by value continues to be a key driver of Peru's economic and social development at both the macro and micro levels.•

Mining Production

New copper projects are adding significant capacity, but the country's largest gold mines are depleting

2018 saw no significant changes in Peru's copper production. The annual total of 2.44 million tonnes (mt/y) actually represented a slight decrease of 0.4% year-on-year. The country should, however, see an important increase in volumes in the coming years. For starters, the expansion of Toromocho is taking the plant from 120,000 mt/d to 170,000 mt/d, which should yield a 45% increase in copper production after commissioning; Minsur's Mina Justa, under construction, will add 100,000 mt/y of copper, including 58,000 mt/y of copper cathodes; and the largest project in the pipeline, Anglo American's Quellaveco, also under construction, will produce 300,000 mt/y of copper starting in 2022.

The market is currently dominated by the large open pit segment, since eight mining operations run by seven companies represent more than 90% of the country's total output. According to data from the Ministry of Energy and Mines, the main producer continues to be Cerro Verde, the mine operated by Freeport McMoRan in Arequipa, with 494,300 mt/y, followed by Antamina (a BHP-Glencore-Teck-Mitsubishi joint venture) with 459,500 mt/y, and Las Bambas, operated by MMG, with 385,300 mt/y.

After that comes Southern Copper with 330,800 mt/y between Toquepala and Cuajone; Chinalco, with 208,300 mt/y at Toromocho; Glencore's Antapaccay with 205,400 mt/y; and Hudbay Minerals with 122,200 mt/y at Constancia.

Comparing results with 2017, Antamina, Southern Copper and Chinalco recorded positive growth in 2018 (4.6%, 8.1% and 7%, respectively), while production decreased slightly at Cerro Verde (-1.5%). Las Bambas' output decrease was caused by a wall instability issue at the Ferrobamba pit, yet company sources assure that this does not change the long-term projections for the operation.

The initial plan for Las Bambas was to complete the first five years of operation with a total of 2 million mt of copper produced. While in 2017, production at Las Bambas was exceptionally high at 459,500 mt/y, the guidance at the beginning of the year was between 385,000 and 405,000 mt/y for 2019. Despite the road blockade by local communities, MMG reported production of 101,452 mt of copper concentrate during Q1 2019. Suresh Vadnagra, general manager of operations for the Americas at MMG and president of Minera Las Bambas, gave more details about some of the efficiency initiatives undertaken to eliminate bottlenecks: "In H2 2018, we were able to operate the plant at an annualized throughput rate of approximately 52 million mt/y, which exceeds the nameplate capacity of 51 million mt/y. We also delivered a 1% improvement in recovery. We have an aggressive work program to continue debottlenecking the operation."

Las Bambas is currently exploiting the Ferrobamba open pit, but the mine plan includes the Chalcobamba and Sulfobamba satellite pits as well. The potential of Las Bambas does not end there, affirmed Vadnagra: "The three pits currently part of the project represent less than 10% of the overall Las Bambas tenement, which is 35,500 hectares. The current mine life is more than 20 years, but we see the potential to continue for 60 or 70 years so we plan for the long term."

In addition to these large open pit copper operations, Peru offers copper production from medium-sized underground mines. These include Buenaventura-controlled El Brocal, that yielded 47,300 mt/y; Cerro Lindo, the largest operation by Brazilian company Nexa Resources (formerly Milpo-Votorantim), that produced 39,800 mt/y; and Condestable, operated by private company Southern Peaks Mining, which had 18,000 mt/y copper production in 2018.

As part of a plan to launch an IPO in Toronto last year, which was ultimately postponed, Southern Peaks undertook an extensive exploration campaign to expand reserves. Adolfo Vera, president and CEO of Southern Peaks Mining, related: "Historically, Condestable always had between three and four years of reserves, with 10 million mt that were regularly replenished, but now we have 24 million mt of reserves. The idea is to keep that figure moving forward," he said.

Condestable is currently operating at level -520, and Vera explained that the drilling campaigns done have reached level -1,000, where mineralization continues. Based on this, the company is currently expanding volumes at the operation: "We already have the permits to go from 7,000 mt/d to 8,400 mt/d and, following a new EIA approval process, by 2021 we should be processing 10,000 mt/d. That is nearly a 50% expansion of today's production rate, and it will be achieved with a very reasonable capex," Vera added.

Southern Peaks is also adding a new operation to its portfolio; the Ariana mine located in Junín, already under construction. Ariana has 16 million mt of resources and will initially process 2,000 mt/d. "Between Ariana and the Condestable expansion, we are moving from 23,000 mt/y copper equivalent to 42,000 mt/y copper equivalent, and our combined all-in cash cost will go down from US$1.54 per pound (US$/lb) to US$1.12/lb. That puts us in the first quartile of costs, typically populated by the large open-pit mines," Vera concluded.

PRECIOUS METALS

Buenaventura leads the ranking of Peru's mining producers in both gold and silver. In gold, between its own operations and its stake in Yanacocha (the country's largest gold mine, operated by Newmont), the company had a total attributable production of 590,100 oz/y in 2018, accounting for nearly 13% of the country's total gold production of 4.59 million oz.

Silver production in Peru was 133.8 million oz last year, 5.8% down year-on-year. A big chunk of that total is produced as a by-product of the large copper mines, like Antamina and Toromocho. The country's main primary silver mine is Buenaventura's Uchucchacua, which yielded 15.4 million oz/y. Buenaventura's total attributable silver production was 24.7 million oz last year.

Over the last months, Buenaventura has focused its efforts on a debottlenecking program across the company's four main operations: Orcopampa and Tambomayo (gold), Uchucchacua (silver) and Marcapunta (copper), for a total capital expenditure of between US$35 million and US$45 million. Víctor Gobitz, CEO of Buenaventura, gave more details: "We are improving the lifting, dewatering and ventilation infrastructure, while changing the mine preparation and extraction method as well. We are also obtaining more precise geological information ("in filling"), which allows us to be more effective with our mine planning."

Gobitz highlighted that the debottlenecking program offers quicker returns than greenfield projects, yet the company is also advancing new ventures. In gold, the company has San Gabriel, located in Moquegua. "We have very solid knowledge about San Gabriel's geology and metallurgy, but there is an issue with the rock quality, which is very soft, so we need more geo-mechanical studies. If we overcome this issue, the project will move quickly, because we already have the EIA for it," said Gobitz, adding that San Gabriel would process 3,000 mt/d and produce between 140,000 and 160,000 oz/y of gold.

After Buenaventura, the country's main gold producers are Barrick (332,100 oz/y from Lagunas Norte and Pierina), Minera Poderosa (278,700 oz/y), Newmont (264,200 oz/y attributable from Yanacocha), Tahoe Resources (243,000 oz/y between La Arena and Shahuindo), Aurífera Retamas (201,300 oz/y), Consorcio Minero Horizonte (182,900

"Peru is ideally placed to capitalize on the growth in copper demand. With the right support and direction from government, I believe Peru could become the world's largest copper producer in the coming years."

-Suresh Vadnagra, President, Minera Las Bambas (MMG)

"The last M&A activity in gold shows a positive tendency, whereby shareholders' value has become the most relevant factor. Furthermore, certain operations may become negligible for the big players, thus opening up new possibilities for medium-sized companies."

-Ignacio Bustamante, CEO, Hochschild Mining

oz/y), Hochschild Mining (181,200 oz/y) and Gold Fields (157,800 oz/y from Cerro Corona).

Yanacocha's total gold production last year was 514,600 oz/y. While the mine remains the country's largest single gold operation, output is expected to continue declining. Through the Quecher Main project, Yanacocha should yield 200,000 oz/y through 2027. Meanwhile, Barrick's Lagunas Norte, Peru's largest gold mine after Yanacocha in years prior, is currently facing the depletion of its oxide reserves, and pit operations are expected to end this year.

Peru's gold segment therefore seems to be maturing, at least in terms of the larger operators, and companies are focusing on stretching mine-life as much as they can. Like elsewhere in the world, the industry is suffering from the lack of new discoveries.

In the case of Gold Fields, last year the company announced that it is extending the life of Cerro Corona from 2023 to 2030, despite the limitations the operation has in terms of footprint. Cerro Corona is actually a gold-copper operation, and total output including copper was 314,000 oz/y gold equivalent in 2018. The mine, located in Cajamarca, continues to be one of the best-performing operations for Gold Fields globally, with all-in costs below US$700/oz.

Photo courtesy of Nexa Resources

Luis Rivera, executive VP of the Americas for Gold Fields, explained that the plan is to further extend operations at Cerro Corona: "This year we are going to do a preliminary study to extend mine life to 2033 or 2034. For that, we are evaluating the use of new technologies. By 2030, the pit is going to become a tailings storage facility, so any plan beyond 2030 requires the introduction of mixed disposal technologies to filter the tailings and stack them together with the waste rock. This way we can optimize the use of space."

While the production costs at Cerro Corona are tremendously competitive, this is not the case elsewhere on the gold spectrum, said Rivera: "Today, the average cost of a gold operation worldwide, including exploration, is US$1,200/oz. If the gold price was below that figure, many mines would have to shut down. This is why gold is not going under $1,200/oz, and we are even seeing a small rally with prices above US$1,300/oz."

Finally Hochschild, in the past a primary silver producer, is also a significant gold producer today thanks to its flagship Inmaculada operation. Last year this mine, located in Ayacucho, produced over 251,000 oz/y gold equivalent. The company's other two assets in Peru achieved mixed results: while Pallancata's production was up by 22% for a total of 9.4 mililon oz/y silver equivalent, thanks to the new Pablo vein, Arcata's operation was put on care and maintenance. Ignacio Bustamante, CEO of Hochschild, explained the rationale behind this move: "Arcata is a mine that had been operating for 55 years with a three-year life. Because of changes in permitting, we were unable to drill for two years, so we ran out of ore. We recently found a new area that is called Quadrant IV but, by the time we prove the resources, obtain the permits and develop the mine, we are talking a further three years before we can put Arcata back into production."

The prospects are certainly better for Inmaculada, as the company recently found 17 new structures in this mine, adding 1.3 million oz gold equivalent. This will allow Hochschild to extend Inmaculada's mine life from four to 10 years.

BASE METALS

Zinc production remained stable in 2018, with negligible growth of 0.1% for a total of 1.47 million mt/y. The main producer of zinc is Antamina, which continued growing its zinc production (475,700 mt/y, +7.5%) after a spectacular 69% increase recorded in 2017. The other main zinc producers in Peru are Volcan, now controlled by Glencore, and Nexa Resources.

In parallel to this, lead production was 289,200 mt/y (a 5.7% contraction); molybdenum production was stable at 28,000 mt/y; iron ore production grew by 8.3% to reach 9.5 million mt/y thanks to Shougang's expansion; and tin output by Minsur saw 4.6% growth for a total of 18,600 mt/y.

One of the country's traditional polymetallic mines is Yauricocha, 82%-owned by Sierra Metals, a listed company that also has two mines in Mexico. Yauricocha is located in the Lima region and currently operates at a 3,150 mt/d rate producing zinc, lead and copper, with some gold and silver content as well. Last year, Sierra Metals increased resources by 134% and is evaluating a potential plant expansion to 3,600 mt/d for 2020, according to the company's president and CEO, Igor Gonzales.

Gonzales developed on the company's efforts to increase mechanization levels at Yauricocha: "We have introduced many improvements in rock support and we still have space to make our sub-level caving method more efficient. We have just concluded a tunnel to connect the mine with the plant, which generates significant savings in transportation. In addition, we are investing to have 100% of the mine covered by our ventilation systems, and we are expanding our pumping systems as well." Sierra is also investing US$8 million in a fourth shaft in the operation that should be operational in 2021.

"We expect zinc to stay around US$1.25/lb because inventories are low and smelting capacity is limited, especially in China. The trade wars have affected the valuations of mining companies, but once we overcome this problem, we will see a renewed appetite for investment in mining."

- Igor Gonzales, President and CEO, Sierra Metals

Asked about the current zinc fundamentals and the market valuations of zinc producers, Gonzales replied: "We expect zinc to stay around US$1.25/lb because inventories are low and smelting capacity is limited, especially in China. Last year we did three PEAs showing that Sierra Metals' stock should be valued at US$4. The trade wars have affected the valuations of mining companies across the board. Once we overcome this problem and we realize the real demand for metals consumption, we will see a renewed appetite for investment in mining," he concluded.•

"Investors are not taking advantage of the current market, so we need to open up new exploration frontiers"

Silvia Rosas
President,
ProExplo 2019

What is the focus of the 2019 edition of ProExplo?

This year the event is focused on science and innovation. We are discussing mining exploration in a holistic manner, from the first steps to the economic evaluation of resources. Within this, we are putting emphasis on how innovation is being applied to the exploration industry through new methodologies such as hyperspectral core imaging, Big Data and Machine Learning. Today there are sampling technologies that are much more accurate and efficient than before; instead of parts per million, we now talk of parts per billion. We can go much more into detail and find anomalies at larger scales. This will improve results, and also attract the interest of investors.

Is technology pushing the need for training?

New technologies require stronger education and a bigger innovation push, yet in Peru there are some limitations in these areas, as we still have not incorporated relevant certifications for geologists, while Colombia and Chile already have their own systems. Peruvian geologists that want to be certified have to go abroad, for instance, to become 'Qualified Persons' following the Canadian standard.

What is your view of the current exploration cycle?

Exploration is picking up, but this reactivation is different to what we have seen in previous years. Most of the budget is going to brownfield projects; there is not much greenfield exploration due to the market's decreasing appetite for risk. We need to open up new frontiers, because investors have access to a wider range of opportunities, yet they are not taking advantage of the current market. Without exploration, none of the large mining deposits today in production would exist. It is likely that we will reach a point of crisis when the industry realizes there are no new deposits and that will trigger the start of a new cycle.

How should community relations be handled during exploration?

Exploration professionals should be sensitive to the on-the-ground reality of the different regions within Peru. When you establish a dialogue as equals characterized by respect and fairness you achieve the most successful relationships. On the other hand, providing only partial or ambiguous information about a project is the worst strategy. Successful projects are born out of trust, and there is no space for opportunistic people to generate conflicts. Indeed, in an honest relationship, the communities themselves will defend the projects that are instrumental for their own development.•

"TMX Group sees Peru as a leading country in Latin America in terms of mining"

Dean McPherson
Head of Global Mining,
TMX Group

Can you give a brief overview of TMX Group and its role in the mining industry's financing?

Toronto Stock Exchange (TSX) is the fourth largest marketplace globally, but we are the largest stock market for mining companies in the world. Approximately 49% of mining financings in 2018 were done on TSX, and over CAD$40 billion of mining funds have been raised on our markets in the last five years. As of the end of 2018, we had close to 1,200 mining companies listed on both TSX and TSX Venture Exchange (TSXV), and 50% of the mining companies that are publicly listed globally are on our exchanges.

How important is Latin America for TMX Group?

Latin America hosts the second largest concentration of our issuers' mining properties, after Canada. Mexico is ahead in terms of how much mining is represented on our marketplace; however, we definitely see significant opportunities for growth in this respect from the rest of Latin America. Our commitment and the importance of Latin America is demonstrated by our recent establishment of an on-the-ground presence in Lima (Peru), led by Guillaume Légaré, head of South America for TSX and TSXV.

What is the importance of dual listing agreements and how is TMX Group working to spread the NI 43-101 standard across Latin America?

We believe that NI 43-101 is at the center of our markets' integrity, as it allows companies to represent opportunities to investors in a consistent, fair, clear and standardized matter. This, in turn, provides for more consistent and often better valuations for mining companies. We see significant opportunities for dual listings in the region to give employees and other local stakeholders an opportunity to participate in long term wealth creation and financial benefits, by owning and trading (in local currencies) in the stocks of mining companies operating in their communities.

What opportunity do you see in Peru as a mining country?

TMX Group sees Peru as a leading country in Latin America in terms of mining. Peru has great governance and transparency, which continues to improve and is bringing more confidence to investors. The country has recognized the importance of mining for economic growth. Other nations in Latin America can benefit from looking at Peru as an example. We are committed to promoting the entire Latin American region and will continue to support the advancement of the mining industry in Latin America and Peru in particular.•

Peru's Junior Segment

Juniors have good projects to work on, but continue to suffer costly delays to obtain government permits

The mining industry has entered a positive cycle with more stable commodity prices, yet the high risk/high reward money for exploration, which left the market during the crisis, is returning very slowly. During this timeframe, both institutional and retail investors have been lured by other options, so for juniors to have access to financing, they need to have good-quality projects, a management team with a proven track-record and a compelling story to attract capital.

Jorge Granda, general manager of AK Drilling, a drilling contractor that serves both major and junior companies in Peru, elaborated on this: "While marijuana and bitcoin did turn some investors away, at the end of the day gold continues to be a safe investment, while copper is tied to global economic growth. In Peru, the main problem is permitting: to have more projects like Quellaveco or Mina Justa, you need to promote exploration, and companies today have to wait between six months and two years to obtain the drilling permits."

While the authorities need to make sure companies operate in a responsible way, protecting the environment and the rights of the local populations, such delays affect not only the juniors' cash position, but also their market perception. Indeed, if the Peruvian administration really wants to reach its goal of attracting 8% of the world's exploration budget (currently it receives 6%), it needs to make life easier for explorers.

In any case, there is optimism in the market, and good news is coming from a variety of fronts in Peru's junior segment. Beyond the progress made across different exploration and development projects, Peru has strengthened its ties to Canadian financial markets, thanks to the TMX's opening of a Lima office this year. This is certainly a positive development at a time where financing for juniors continues to be difficult. Dean McPherson, head of Global Mining at TMX Group, affirmed: "We see Peru as a leading country in Latin America for mining. Peru has great governance and transparency, which continues to improve and is bringing more confidence for investors."

GOLD

The past months have been eventful for PPX Mining, as the company completed its pre-feasibility study for the Igor gold-silver project and obtained the final permits to build the processing facilities. The initial underground mining development is already done, therefore the capex left to put the project into full production is less than US$4 million, explained Brian Maher, president and CEO of PPX Mining.

"At Callanquitas [part of the Igor project] the underground mine is already working at 120 to 130 tonnes per day (mt/d), and has produced around 8,000 oz of gold since we started our test mining and bulk sampling program in 2017. Now, for a modest capital contribution, we are buying a crushing plant, an agglomerator and a Merril Crowe plant, all of which can take 1,200 mt/d in the future."

The initial production rate at the Igor project will be 350 mt/d, which will allow for an eight-year mine life and total production of 120,000 oz gold equivalent. The company envisions expanding both tonnage and mine life through exploration, based on the potential at both the Callanquitas and Portachuelos areas within the Igor project.

Maher explained that the focus of the subsequent exploration campaign (17,000 m planned during 2019 and 2020) will be threefold: to drill in and around Callanquitas to drive plant expansions; to do more drilling in Portachuelos; and to target the Tesoros area, on the southern side. "Portachuelos has the potential to be a game-changer for us. The sheer size of that system requires us to start defining the limits of the deposit," he said.

Meanwhile Palamina, an exploration company, is focusing on the Puno orogenic gold belt, and more specifically on the Coasa gold project, which includes the Veta discovery zone where the company plans to drill 2,500 m this year.

Andrew Thomson, president and CEO of Palamina, affirmed that the project also hosts the Phusca shear zone – potentially an extension of the Ucanuma shear zone that hosts Goldmining Inc.'s 1-million oz Crucero gold deposit. "In Coasa's Veta zone, surface gold assay results are much higher than those of Crucero, and we cover a much larger area, so we are very excited to carry out our initial drill program. We see potential for open pit mining, but drilling is definitely required to determine a third dimension," he said.

Another gold-focused company is Pucara Resources, a private entity that is looking at going public sometime this year. The company has a portfolio of 14 projects following the project generator model, but is also funded to carry out its own exploration programs. In this respect, the company is focusing on its Lourdes and Pacaska gold projects in Ayacucho.

In terms of Lourdes, Pucara's CEO, Steve Zuker, said: "Lourdes is located in a belt of Miocene volcanic rocks, host to other gold deposits. The texture and clasts of rocks are indicative of multiple hydrothermal events occurring, increasing the chances of one or more of them carrying significant amounts of gold. The first phase of drilling will be 3,000 m in 10 to 15 drill holes."

Meanwhile in Pacaska, Pucara is planning to carry out an IP geophysical survey. So far the project shows significant gold values at surface (7 g/mt Au) in hydrothermal breccias and vuggy silica, according to Zuker.

"Replacing ounces of gold and pounds of copper has become much more difficult. The easy, high-quality projects in Canada and South America have already been found, so it is going to take a considerable amount of perseverance, luck and thinking outside the box to find something new."

-Ivan Bebek,
Executive Chairman,
Auryn Resources

COPPER

The last 12 months have been eventful for Regulus Resources. While last year the company spun out its Argentinean assets into a new vehicle called Aldebaran Resources, Regulus recently published an updated resource estimate at its flagship AntaKori project located in Cajamarca. The new resource contains 250 million mt with 0.48% Cu, 0.29 g/mt Au and 7.5 g/mt Ag (indicated) plus 267 million mt with 0.41% Cu, 0.26 g/mt Au and 7.8 g/mt Ag (inferred).

John Black, CEO of Regulus Resources, gave more details about these results: "We have seen an approximate 75% increase in the size of the deposit while maintaining similar grades. There has thus been a substantial increase in the total amount of contained copper and gold, and we have very good combined grades, with an average of 0.7% copper equivalent."

Speaking of metal content, AntaKori contains approximately 8 billion pounds of copper equivalent (Cu equivalent),

versus 5 billion pounds Cu equivalent in the previous resource estimate. From a gold perspective, this equates to 17 million oz gold equivalent, said Black, who added that there is potential for the resource to continue growing: "We are by no means getting to the edge of the system yet, and the Phase 2 drilling program is underway with more than 25,000 m planned for 2019."

AntaKori is located right next to the Tantahuatay gold mine, owned by Coimolache (a joint venture of Buenaventura and Southern Copper). Currently a gold oxide mine, Tantahuatay will transition into a sulphide copper-gold operation at some point. Regulus has collaborative agreements with Coimolache and Buenaventura for exploration, yet Black said that it is still early to define how the district will evolve.

Another junior with an active exploration program is Chakana Copper at the Soledad project in Ancash, which has already completed over 25,000 m of drilling and is processing permits for a further 20,000 m. In May 2019, Gold Fields acquired a 16% stake in Chakana. Soledad is a breccia-type system, and Chakana is applying a different exploration approach to the one used by previous explorers in the area, who were looking for a large porphyry.

"Gold Fields' recent C$8 million investment in Chakana Copper is a great endorsement and validation of the exploration work we have completed thus far. It also brings Gold Fields' technical and operational capabilities in Peru together with our team to help us unlock the potential of the Soledad project."

-David Kelley, President and CEO, Chakana Copper

David Kelley, president and CEO of Chakana, explained: "Our story has always been about having multiple deposits in a single cluster, and our exploration has focused on defining how many of these breccia pipes there are. To date we have confirmed 17 of these pipes that are cropping out."

While the company has identified 11 additional areas that are strongly altered, Chakana wants to start proving economic mineralization in four or five pipes with an initial inferred resource and then increase that with the remainder of the 17 known pipes. Kelley highlighted the importance of gold and silver for the project, with 65% of the value in breccia pipe 1 coming from precious metals. He also emphasized the economic and social advantages of a potential operation at Soledad: "Mineralization goes at depth within a very small footprint. There is also 500 m of relief from the bottom to the top of the project, so you can access mineralization at various elevations early-on in the mine life. After that, the infrastructure can be developed to access multiple pipes simultaneously, using standard underground methods."

Auryn Resources has also entered the country to tap into Peru's copper and gold potential. The company, 11.8%-owned by Newmont, expects to replicate its team's previous success stories with Keegan Resources (now Asanko Gold) and Cayden Resources (sold to Agnico-Eagle). Through Miguel Cardozo, a well-known local geologist, Auryn has obtained access to a number of copper and gold projects in southern Peru, namely Sombrero, Baños del Indio, Huilacollo and Curibaya.

Ivan Bebek, executive chairman of Auryn, affirmed that finding good projects is increasingly challenging: "Major companies have to replace ounces of gold and pounds of copper, and to do that has become much more difficult. We believe that the easy, high-quality projects in Canada and South America have already been found, so it is going to take a considerable amount of perseverance, luck and thinking outside the box to find something new."

In Peru, the initial focus is on the Sombrero property, where Auryn has expanded its initial land position to the current 120,000 hectares. "Sombrero has the same types of rocks and mineralized intrusions that we see in the Las Bambas-Tintaya belt," said Bebek. "Other companies likely missed this opportunity because of the volcanic cover in this part of the belt. Also, we have found significant sulphide mineralization outcropping that carries as high-grade – or even higher grade – as the oxide zones," he added. Auryn expects to undertake a maiden drill program at Sombrero in Q3 or Q4 2019, for a total of 15,000 m.

Finally, Latin America Resource Group (LARG) is a private company focused on the Jasperoide copper project in Cusco, located between the Las Bambas and Constancia copper mines. Jasperoide's land package includes 1,200 hectares that LARG acquired from Hochschild (with an internal resource of 50 million mt at 0.8% copper equivalent) and 7,100 additional hectares in the same district. The company re-logged all core previously drilled, which helped define five different styles of mineralization, ranging from lower grade skarn to high-grade copper-gold mantos.

Kimberly Ann, president and CEO of LARG, elaborated on the company's subsequent steps at Jasperoide: "We moved on to

Photo courtesy of Geotec

metallurgical testing and we have had very good recoveries of 93% in gold and 73% in copper. Utilizing this data, we updated the economic model for the project, and it shows the existing historic resource could support a robust open-pit mine."

In January, the company received the approval for the environmental impact declaration (DIA), so once the water permits are in place, it will be able to start drilling at Jasperoide, for an initial 3,000 m to 5,000 m campaign. The idea is to verify the historic resource and follow up on previous drilling to the north. Kimberly Ann added: "We have good grades if we compare ourselves with the minerals our neighbors are mining. We have this unique system where we have stacked high-grade mantos underneath disseminated, lower-grade copper that extends to the surface. The mantos grade between 2% and 3.5% copper with high gold grades as well, in addition to being very thick. So, we want to drill out some of those and have those results support the transaction to go public."

ZINC

Following the strong performance of the zinc price over the last couple of years, the market is seeing a renewed interest in the metal. In Peru, the largest undeveloped zinc deposit is Tinka Resources' Ayawilca, located in central Peru. Following a recent resource expansion, Ayawilca now has 11.7 million mt at 6.9% zinc (indicated) and 45 million mt at 5.6% zinc (inferred). Including the indium, silver and lead content, the zinc equivalent grades are 8.1% and 6.7%, respectively. Additionally, Ayawilca has a separate tin resource of 14.5 milion mt at 0.70% tin equivalent (inferred).

In April 2019, Tinka resumed drilling activities at the project with a new 10,000 m campaign, with the objective of testing new zones, finding more ore and doing some in-fill drilling in support of the future pre-feasibility study, said Graham Carman, president and CEO of Tinka: "There are still open areas at depth and on the edges of the deposit. Last year we found that zinc grade increased significantly with depth. We had one hole that intersected 10 m at 44% zinc underneath the previous resource, which is basically direct shipping ore in terms of grade."

In parallel to the exploration, Tinka is already moving into the engineering phase with the completion of a preliminary economic assessment (PEA) this year. To support this step, the company hired Ken Engquist, who was formerly involved in Arizona Mining. Arizona Mining was one of the latest success cases of M&A in this segment,

having been acquired by South32 last year for US$1.3 billion. Carman added: "We believe that Ayawilca still has the potential to contain 80 to 100 million mt of mineable zinc mineralization […] Following the PEA, we will consider a strategic partner, if it makes sense to do so."

LITHIUM AND URANIUM

For years, Plateau Energy Metals (previously Plateau Uranium) worked on the consolidation of extensive uranium resources in the Macusani district in Puno, south-eastern Peru, but the Falchani lithium discovery changed the company's focus. The lithium resource built up very quickly, and the recent resource update announced in March 2019 reported a 90% increase in tonnage for a total of 4.7 million mt of lithium carbonate equivalent (LCE). According to Alex Holmes, CEO of Plateau Energy Metals, this is the world's sixth largest hard rock lithium project, and the value in the ground at Falchani is around US$60 billion.

However, Holmes said the company still needs to educate investors on the particularities of Falchani, considering South America is mostly known for brine-type lithium deposits: "The host rocks at our lithium project are volcanic mostly as a lithium-rich tuff (hardened volcanic ash), which is believed to be similar to the lithium source rocks (volcanic rocks) for brine projects […] Thus, we refer to our lithium project as a 'solid brine.'" Plateau has been testing different methods of recovery, including tank/vat leaching, roasting, baking and heap leaching, and the company will now start to focus on the engineering aspect of the project, while it will also look at potentially expanding the resource toward the west and the north.

"In March 2019, we increased the total resource estimate by approximately 90%, which puts Falchani as the world's sixth largest hard rock lithium project with 4.7 million mt of lithium carbonate equivalent (LCE). By our calculations, this means that there is approximately US$60 billion of value in the ground at Falchani."

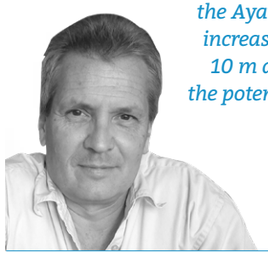
- Alex Holmes,
CEO,
Plateau Energy Metals

With regard to Plateau's uranium project, the company is waiting for the legal framework for uranium exploitation to develop in Peru, as well as for better uranium prices. In any case, the uranium project could be placed into a different investment vehicle, said Holmes: "Even though both uranium and lithium speak well into the green energy market, the equity investors on our two projects are very different. We are thus considering strategic options including a potential spin-off, joint venture with the right strategic partner or other alternatives."•

Peru: Multi-Commodity Potential

"We have seen a 75% increase in the size of the AntaKori deposit while maintaining average grades of 0.7% copper equivalent. We are by no means getting to the edge of the system, and the Phase 2 drilling program is underway with more than 25,000 m planned for 2019."

- John Black,
CEO,
Regulus Resources



"There are still open areas at depth and on the edges of the Ayawilca deposit. Last year we found that zinc grade increased with depth, and had one hole that intersected 10 m at 44% zinc [...] We believe that Ayawilca still has the potential to contain 80 to 100 million mt of mineable zinc mineralization."

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"At Jasperoide we have good grades if compared with the minerals our neighbors are mining. The mantos grade between 2% and 3.5% copper with high gold grades as well, in addition to being very thick. Having good drilling results there would support our transaction to go public."

- Kimberly Ann,
President and CEO,
Latin America Resource Group (LARG)

A Key Market for Consultants

The uptick in activity translates into more work across the board for engineering and specialist firms

If 2018 had begun with a greater buzz for engineering firms than seen in previous years, 2019 has continued this trend and most consulting firms in Peru are reporting growth.

Carlos Santa Cruz, president of the board of BISA Ingeniería de Proyectos, a local engineering firm that was until recently part of Buenaventura, affirmed that the mining sector had a "great performance" in 2018, but he warned that firms must nevertheless maintain a healthy level of industry diversification: "After the last super-cycle, there was a lot of spare capacity in engineering, and companies had to adjust their teams. If you do not have a good balance between different sectors, you are at the mercy of the mining cycle."

Paul Murphy, manager for South America at Mining Plus, an Australian consultancy firm, has also seen a boost in market dynamics over the last couple of years: "Studies such as scoping, pre-feasibility and feasibility studies came back strongly after the downturn. Over the past few years, the revenue breakdown was approximately 70% operational work and 30% studies. Now, the overall workload has doubled and the percentage of studies versus optimizations has reversed."

The year started strongly for SNC-Lavalin as well. Its general manager in Peru, Alexandra Almenara, related: "Toward the end of last year we saw an explosion of requests from different clients and we were awarded some important projects, especially in engineering and construction supervision."

SECTOR CONSOLIDATION

Through M&A activity, several players have strengthened their presence in the country. The former MWH, for instance, has now become Stantec through the combination of both firms. Meanwhile, WSP has made a series of acquisitions in the last three years, namely Schlumberger Water Services, POCH, ConCol and most recently Louis Berger. Furthermore, in 2017, Amec Foster Wheeler was acquired by Wood Group in a US$2.7 billion transaction.

The new Wood combines Wood Group's experience in oil and gas with Amec's track record in mining and metals, environment and mine infrastructure. According to Franco Pedraz, Peru operations manager for Mining and Minerals at Wood, the company covers a comprehensive range of services from front-end geology to mine closure, including the latest tools to automatize operations: "Our automation and control business provides artificial intelligence services for the integration of complex systems with process and facilities automation through remote controls, virtual systems and robotics."

The decline of commodity prices in previous years led mining operators to optimize ongoing projects and increase production through the implementation of new technologies, affirmed Pedraz. In this context, the latest projects for Wood's Lima office in mining and minerals have been with Minsur's San Rafael tin mine: first, the ore sorting project, with the application of an innovative technology in the country's mining sector; and secondly, the B2 project. Pedraz elaborated on the latter: "The B2 project, which includes tailings reclamation, re-processing and obtaining tin recovery, has been developed 100% in our Lima office – from concept to execution. We have already reached 2 million man-hours without lost time incidents."

Wood now has 60,000 employees worldwide, including 4,000 in the Mining & Minerals division, and WSP also has ambitious plans to grow from its current level of 48,000 employees to 65,000 people by 2021. Gonzalo Covarrubias, recently appointed Peru general manager at WSP, summarized the main areas of expertise absorbed by the company through M&A: "Schlumberger Water Services was a highly-reputable firm in water management; POCH had engineering experience in Chile and Peru; and Concol was a Latin American leader in power transmission projects. To all this we have now added Louis Berger's great capacity in infrastructure projects."

Covarrubias added that the strategy is to position WSP as a long-term strategic consultant to work with the clients throughout the whole project cycle. "We are not active or inactive depending on the projects; we want to help clients meet the challenges of the future, and that requires a multi-disciplinary approach," he said. As an example, the company is already using its power transmission experience to design the transmission line for Quellaveco. "Mining clients are large consumers of energy, and we can do all the technical, environmental and economic analysis so they can select the best option, which could be to connect to the grid or to develop self-generation or hybrid solutions," he explained.

"During the decline in copper prices, clients focused on project optimizations to produce more and close the revenue gap with the implementation of new technologies. We took that opportunity to add strong expertise in ore sorting and tailings recovery."

- Franco Pedraz, Peru Operations Manager Mining & Minerals, Wood

Finally Alberto Coya, general manager of Stantec in Peru, also outlined the synergies created by the Stantec-MWH merger: "MWH had a wider geographical footprint, whereas Stantec had a deeper service portfolio. Under the new structure, in Peru we have incorporated new services such as underground mining, and we have consolidated the water treatment offering that MWH had in other countries but not in Peru."

OPTIMIZING PROCESSES

While the construction of new mines like Quellaveco and Mina Justa is controlled by the EPCM players (Fluor and Ausenco, respectively), ongoing operations continue to be a great source of work for engineering companies.

Denys Parra, general manager of Anddes, a local engineering firm with 300 people in Peru, explained: "Once the mine starts production, the opportunities are endless. For instance, we have 30 people in Cerro Verde giving support in electro-mechanical projects, and we are participating in many projects in areas such as piping, power and instrumentation, sometimes through master engineering contracts."

Indeed, confronted by the various challenges of building greenfield projects, many operators have remained focused on extracting the maximum value from their existing sites. Buenaventura's debottlenecking program is an example of this, but not the only one. Hatch, for instance, is advising Nexa on a debottlenecking program at the Cajamarquilla zinc refinery. Following this trend, a number of companies in the segment are finding their own niches and acting as external advisors; for example, Hatch actually has a transversal Advisory practice covering mining, energy and infrastructure.

The opportunity to add value to the vast range of installed mining facilities in Peru has also attracted new players to this segment. Keypro of Chile, for instance, is opening an office in Lima. Jorge González Cohn, the firm's general manager in Peru, gave more details: "We are known for our debottlenecking solutions for concentrators. We have a specialized unit in metallurgical optimization, and we already see a space in the market because many plants will require modernizations, expansions and low-cost optimizations."

This, said González Cohn, would be a good entry door for the firm to then explore other areas where Keypro already has experience in Chile, such as fluid transportation, tailings management and disposal, and energy infrastructure. The firm would also like to capitalize on its Chilean experience in master engineering contracts: "We currently have five such contracts in Chile and, in the last five years, we have invoiced more than US$35 million following this model. This is a tool that is increasingly being used in Peru, so companies can avoid burdensome bidding processes," he added.

UNDERGROUND PLANNING

Peru has a wide portfolio of underground mines, but so far all of them are medium or small-scale. Peru's largest underground operation is Cerro Lindo, with a throughput rate of 20,000 mt/d. In Chile, for instance, Codelco's El Teniente operation has a concentrating capacity of 135,000 mt/d. Yet, the situation is changing: Glencore is advancing the next phase of Antapaccay with the Coroccohuayco project, which has an underground component, while Yanacocha, Peru's largest gold mine, is also entering an underground phase. Antamina's deep pit could also become inefficient in the years to come.

Paul Murphy of Mining Plus affirmed that these large underground operations will become commonplace in Peru in the future: "We are seeing a lot more activity in the mass mining space for underground mining. Pits that are approaching the end of their life have very hungry processing plants that need to be fed. In this context, underground mining methods such as long-hole open stoping with large stopes and multiple mining areas, sublevel caving or block caving will be attractive for operators."

Mining Plus is the consultancy arm of Byrnecut, a large Australian underground contractor that is already taking position in the Peruvian market. Murphy emphasized that large open pit operators need to plan the transition to underground before it is too late to optimize efficiency: "The pit that delivers the most value to the operation in an open cut/underground scenario may in fact be smaller than the 'optimal' open pit considering just the open cut scenario. As such, this study has to be done well in advance."

Gonzalo Covarrubias, General Manager Peru, WSP

Another consultancy firm looking at growth in Peru's underground segment by leveraging its experience in North America is Stantec.

Photo courtesy of Minsur

Alberto Coya gave more details: "In Peru, underground mines are dominated by local companies and initially it was difficult for us to transfer our expertise from Canada and the United States. Today, we already have bilingual experts. Moreover, we are working with Yanacocha in one pre-feasibility and two feasibility studies for underground mining."

ENVIRONMENTAL PERMITTING

Beyond engineering, consultancy firms also support clients throughout the whole process of environmental permitting and management. While the lack of greenfield projects in previous years translated into fewer new environmental impact assessments (EIAs), the situation is changing now. However, the lengthy approval process for these studies required by the authorities has remained stagnant.

SNC-Lavalin, for instance, was recently awarded three different EIAs, which the company is running in parallel. Alexandra Almenara said: "This is unusual but it is very positive, because we will be able to share the best practices in these studies to obtain approvals in the shortest time possible."

Denys Parra of Anddes lamented that approving a mere modification of an existing EIA can take as long as processing a new one (this timeframe is currently two and half years). "Today, SENACE [a government body under the Ministry of Environment] is in charge of all the tools for environmental management. We would like to see an optimization of timeframes to be more competitive as a country," he said.

In this respect, striking the right balance between the level of detail EIAs require and an optimized calendar that will not delay investment projects is necessary. Gonzalo Morante, general manager of Walsh, a consultancy firm specialized in the environmental and social segments, said: "Projects have a timeline that needs to be met for economic reasons. At Walsh we aim at producing EIAs that provide greater legal security to clients, while also meeting compliance with the policies of the World Bank, regional development banks or private banks. The EIA needs to satisfy all parties involved, including of course the communities."

Almenara of SNC-Lavalin agreed, stating: "If your environmental management plan is not good, you will have problems during the operation."

Here, another problem arises: since it started handling EIAs three years ago, SENACE has given its seal of approval to hundreds of consultancy firms, while the market only offers a handful of EIAs each year. "Many firms are not serious and that does not help the client because an EIA should be the tool that allows the client to plan and manage the whole operation from an environmental perspective," lamented Almenara.

"In Chile, a highly seismic country, upstream construction is not permitted. In Peru, seismicity is also a concern, although upstream tailings facilities are not illegal. I believe that upstream dams should be decommissioned in the next years."

- Dan Etheredge,
Regional Manager
South America,
Klohn Crippen Berger

TAILINGS MANAGEMENT

The terrible accident at the Brumadinho tailings dam in Brazil is another wake-up call for an industry that, so far, has only taken very modest steps to change the way tailings dams are designed and operated. Solutions for dry stacking are available nowadays, but the cost is still seen as too high for operations handling very large volumes in the context of uncertain commodity prices.

"Brumadinho was built using an upstream construction methodology, meaning that after the starter dam is built and the impoundment fills with tailings, subsequent raises are built upstream of the starter dam, on top of tailings," explained Dan Etheredge, regional manager South America at Klohn Crippen Berger, a firm widely recognized for its

"Mine closure is an ongoing process in Peru, with authorities not providing the final closure certification because there are issues such as acid water. At SRK we have built a multidisciplinary team for mine closure covering water handling and water treatment, ground cover, reforestation and social issues."

- Antonio Samaniego, Director, SRK Consulting

tailings dams expertise. "Downstream construction presents less risk, but it is more costly as it requires significantly more rockfill," he added.

Dams are often looked at as an operational aspect, but looking at the earlier-stage studies, selecting the location of the facility is the first headache that needs to be addressed. According to Heiner Bueno, chief of operations at Arcadis, a Dutch multinational firm: "The main issue is the dam location, and it requires a holistic analysis that considers the economic, technical and social aspects to realize a solution that is sustainable over time."

Etheredge of Klohn Crippen Berger elaborated on this: "A typical tailing site selection study will investigate several alternative locations, rank them, conduct a fatal flaw analysis to eliminate some alternatives and then determine not only the best location option, but also the preferred tailings technology to be employed."

The issue of when mining companies will move toward filtered or dry stack tailings resurfaced in the aftermath of the tailings disaster. Alberto Coya, of Stantec, described how the technology is evolving: "The industry is increasingly evaluating dry stacking as an alternative to the traditional wet tailings storage facility (TSF). More often than not, the conventional TSF appears as the most efficient solution. Each method has its own advantages and disadvantages, depending on the location and the rainfall levels in the area."

Denys Parra of Anddes agreed that the industry has made only tentative moves toward dry stacking and that in Peru, handling filtered tailings becomes difficult during the rainy season. Anddes is focusing on consolidating its tailing practice, considering the whole life cycle of the facility – from the design of the TSF and the engineering of the different elements, such as the thickeners, to construction supervision, monitoring and closure. The company has organized a number of tailings safety workshops with the idea of sharing best practices: "Today, more projects have an engineer of record (EOR), as well as an independent geotechnical review board (IGTRB). This means giving the responsibility of assuring the dam's behavior to a particular company or individual," noted Parra.

The problem is that these high-level experts are scarce worldwide, and proper tailings safety reviews are a lengthy process. Antonio Samaniego, director of SRK Consulting, affirmed: "Tailings management is a complex issue because the industry does not have a critical mass of professionals to monitor the existing facilities."

Beyond initiatives coming from within the industry, the mining sector should also expect changes in regulation in the coming years. Etheredge of Klohn Crippen Berger highlighted the risks of upstream dams such as the one that collapsed in Brumadinho: "In Chile, which is a highly seismic country, upstream construction is not permitted. In Peru, seismicity is also a concern, although upstream facilities are not illegal. A few of them have been constructed, yet they are not as common as in Brazil. I personally believe that upstream dams should be decommissioned in the next few years."

And one should not forget the cost of mine closure: if Peru has seen hardly any proper mine closure (meaning the mining company returns the concession to the state), this is because the authorities do not give the final closure certification due to problems related to acid water, related Samaniego of SRK. Samaniego added that, after you stop mining, the next 30 years can be spent carrying out maintenance activities related to tailings.

Pierre Montauban del Solar, general manager of Hatch, commented: "Mine closure when you have conventional tailings is highly problematic. While wet tailings means lower costs of operation than dry stack tailings, the mine closure is much more costly, and also the exposure to risk is higher."

THE WATER CYCLE

Tailings are a key aspect of water management, but by no means the only one. Amphos 21, for instance, a specialized firm that originated in Spain and focuses on overseeing the whole water cycle, sees 90% of its business in Peru coming from mining. The company saw 30% growth in Peru in 2018, and its current local team of 80 people covers areas such as hydrology, hydro-geology and geochemistry, among others.

Eduardo Ruiz, general manager of Amphos 21, affirmed the demand in this business will continue to grow: "These services are necessary and they also add value to mining clients. The market will continue to evolve in terms of water and effluent quality, especially in water management and the optimization of water treatment, which is very costly and ends up impacting the mining companies' cash-flow."

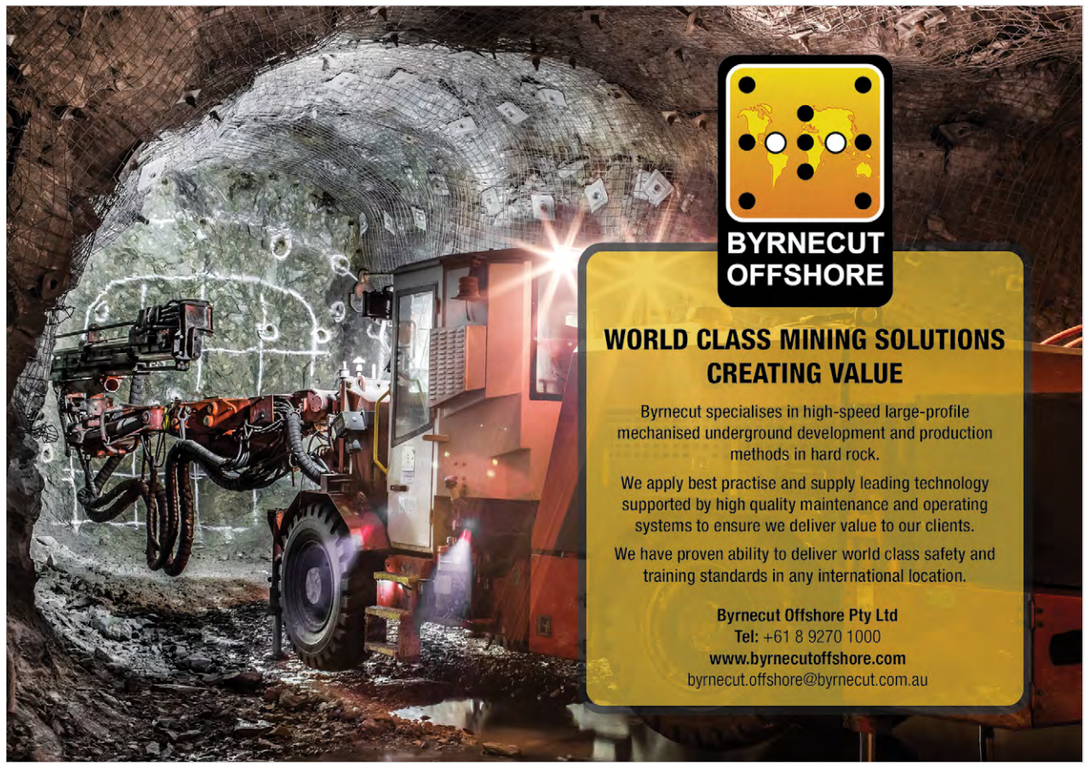
Returning to the Brumadinho issue, Ruiz affirmed that filtered tailings would rely on weather conditions. "In areas where filtered tailings are not possible, you can control the destabilizing elements, one of the main ones being the associated water. In this respect, we have worked to better control the phreatic level within tailings dams." In this context, said Ruiz, the company has been incorporating instrumentation and control tools to its projects to be able to take better decisions.

Beyond managing the risks of wet tailings facilities, the mining industry is also trying to reduce its water usage to avoid confrontations with the local communities. Tetra Tech, an engineering and consultancy firm from California, wants to grow its share of water-related projects in Peru. The company has hired as an advisor Fernando Cillóniz, the former governor of the Ica region. Cillóniz developed a number of water reservoir projects in that region and advocated for more such initiatives in the country: "Peru collects a lot of water in the rainy season, but from May until November, both the coastal and mountain regions are left without water. The message is clear: it is necessary to retain as much rainwater as possible by means of water consolidation with reservoirs," he said.

Tetra Tech's main offices in the region are in Brazil and Chile, from where it also covers other mining areas such as exploration and mining infrastructure. In water, the company's expertise includes wastewater treatment, subsurface aquifer management and desalination.

Eduardo Ruiz, General Manager, Amphos 21

For Cillóniz, mining can be instrumental to solve the seasonality issue of water in Peru, yet he feels mining is being targeted as a problem under the proposed headwater basin legislation: "There is the ridiculous notion that water is generated in the headwaters of the basin when in reality, the basin captures the water wherever it rains, not only in the upper part. Now the legislation wants to prevent mining activity in the upper part of the basin, where the mining deposits are usually located. This is an absurd and very dangerous misconception," he added.•



Builders and Operators

With mining investment expected to reach US$6 billion this year, the industry offers good opportunities for construction and mining operation-related companies

The past few years were tough for the Peruvian construction segment, which was simultaneously hit by both a slowdown in mining investment and, in some cases, corruption scandals involving public officials and construction firms. Focusing strictly on mining, commodity prices rebounded in late 2016, particularly copper; yet in Peru, this only began to translate into higher levels of investment in 2018, as cycles follow their own rhythm and dynamics.

The industry is relieved that the situation is finally changing. Steve Dixon, CEO of STRACON, one of Peru's main mining contractors, said: "It is an exciting time as the industry has picked up." The influx of new projects is undeniable: currently 75% of STRACON's business comes from construction activities, the remainder being in contract mining operations.

STRACON initiated a new era last year when it disengaged from Graña y Montero with the support of Ashmore Group. Then, in October 2018, the company embarked on the acquisition of 60% of Dumas Mining in Canada, a specialized underground contractor. Dixon affirmed that following these developments, 2019 has become a year of consolidation.

STRACON counts Las Bambas, Hudbay, Tahoe (now Pan American Silver) and Anglo American as clients in Peru, and regionally it has been working for years at the large Cobre Panama project, while it is also carrying out open pit operations for Guyana Goldfields. The Dumas acquisition means the company has 12 additional active contracts (10 in Canada and two in Mexico), and a whole set of new capabilities to target underground projects. Dixon commented on the synergies created: "The Dumas acquisition had the objective of growing the underground business in Latin America and North America, as well as to provide STRACON with a platform from which to offer its surface mining and construction services in North America."

UNDERGROUND EFFICIENCY

Thanks to technology and economies of scale, large open pit mines have achieved high levels of efficiency, but the same does not apply to underground mining in Peru. Víctor Gobitz, CEO of Buenaventura, commented that open pit mines enjoy 18 productive hours per day, whereas that ratio goes down to 12 or 13 hours per day underground. Thus, for underground contractors, becoming efficient partners of the mining companies represents a key challenge.

Gianflavio Carozzi, general manager of AESA, one of Peru's largest underground contractors, reflected on the latest market trends: "You have an increasing number of operations, but they tend to be smaller in size because miners are optimizing the infrastructure. They require less meters, and that is a challenge for our business model because it reduces our options to optimize the work by both our people and our machines."

In line with this quest for productivity, some mining companies are looking for a sole integrated contractor that can handle the whole operation. The problem is identifying a company with enough capacity to take on such responsibility. Eduardo Cossio Chirinos, CEO of INCIMMET, another underground contractor, elaborated on this: "Having just one contractor is still difficult in Peru. This will require higher levels of automation and technology; until then, a big leap in terms of volumes translates into higher safety risks for the contractor. In our case, we cannot sacrifice our safety standard just to grow in volumes," he said.

INCIMMET, a Peruvian company created in the 1990s, currently works for Nexa and Buenaventura in Peru, and also has contracts in Argentina and Colombia. The company has followed a professionalization process over the last few years and currently has the triple certification across all its services. In recent years it has also entered the surface mining segment with different contracts for Southern, Cerro Verde, Barrick and Chinalco.

Carozzi of AESA agreed that by and large the Peruvian segment is not ready to transition to the single contractor model yet, although AESA, part of the large economic conglomerate Breca Group, is already diversifying its service range to offer a more complete solution to clients. Carozzi outlined the advantages of integrating the business: "Each contractor in a mine needs to take on a whole set of fixed costs to supervise the operation. If you can dilute that between fewer contractors, the economic benefits are immediate. Also, in terms of safety, having multiple contractors results in bad coordination."

"Finally, looking at productivity, mining extraction is like a puzzle," he added. "If one of the pieces does not fit, the whole mining cycle suffers."

Carozzi was also optimistic about the future development of underground mass mining and anticipated that we will see continuous mining methods for large-scale operations, with the use of tunnel boring machines, for example.

INCORPORATING NEW TECHNOLOGY

Continuous underground mining may be the future, but the underground segment is already incorporating interesting developments. In Peru, these are somehow modest, but the trend is unstoppable. Diego Morales, general manager of Mas Errázuriz, a Chilean contractor that recently completed the river diversion tunnel at Quellaveco, related: "In Chile we already work with remote-control equipment, taking the operator out of the risk areas. Here in Peru, companies have recently started working with mechanized scalers, which was unthinkable just one year ago. Also the jumbos now have rod handlers to prevent any contact between the man and the machine."

Elvis Torres, operations manager at IESA, another contractor, explained that the industry is experiencing significant development in blasting processes, with automation software and sensors, as well as in safety aspects: "The use of bracelets that can monitor vital signs and detect if the operator has had a good rest or not is becoming widespread. If you have not slept, you cannot operate equipment. Four years ago this technology was very costly, but we are already using it at [Hochschild's] Pallancata," he said.

A big limitation for the introduction of technology in Peru's underground segment is the significant amount of narrow-vein operations, as well as the fact that mechanization is still a work in progress. Yet, this has actually boosted local innovation. Tumi Raise Boring, for instance, has designed a raise boring machine that can be used not just for traditional ventilation or ore passes, but also for production processes. Local equipment manufacturer Resemin has become globally

Steve Dixon, CEO, STRACON

Gianflavio Carozzi, General Manager, AESA

Marc Blattner, General Manager, TUMI

recognized in the narrow-vein segment for designing and producing a 1 m wide jumbo. Additionally, Robocon, a shotcrete specialized contractor, recently produced its first robots for shotcrete application, also for narrow-vein operations, through its sister company Tecnomecánica.

Enrique Sattler, CEO of Robocon, highlighted that the development of this new machine, which has a width of 1.6 m and can be used in 3x3 m tunnels, is an enormous milestone in a context where some mining companies want to reduce tunnel sections to decrease dilution, all while maintaining mechanization. The first models are going to be used by Pan American Silver in Peru.

Another technology development by Robocon is the incorporation of the 3D Laser Mapping technology by GeoSLAM across its equipment fleet, a surveying tool that monitors how much shotcrete is being applied in each area of the tunnel in real time. "Until now, this measurement was done in quite a rudimentary way," said Sattler.

Furthermore, the company has the capacity to integrate the shotcrete operations through the implementation of cement plants on-site and the installation of slick lines. Sattler gave more details: "The slick line is a vertical pipe to transport shotcrete via gravity. We already designed and installed a 470 m slick line at Volcan, which helped us reduce the number of machines from 23 to 19 in that operation, which also meant 15 less people. The savings this technology brings are enormous, and yet Peruvian companies are not familiar with it."

While some miners go for smaller tunnels, larger operations also require bigger infrastructure items. Tumi Raise Boring, a specialist contractor that only uses its own machines for its raise boring contracts, is adapting to those needs with the development of the 700 SR machine for 3 m diameter and 150 to 250 m long ventilation holes, the first of which is going to Minsur's San Rafael. "The biggest improvement of the 700 SR is the implementation of new safety features, always looking at removing the human from physical contact with the operation of the machine. It also has new vibration absorbers," said Marc Blattner, general manager of Tumi.

The company has 14 machines in operation, in both infrastructure (ventilation chimneys, ore passes etc) and production processes, and it expects to add two to three more machines by the end of 2019, all of which will be Tumi's SR models. Standing for 'slot raise' and designed and manufactured in-house by Tumi in Peru, the SRs have substantially changed this particular niche of underground mining, assured Blattner: "By now, the standard raise boring machine is becoming a thing of the past: our SR machine is safer, more economic, offers better returns and it is easier to transport. For the six years we have had the SRs in operation, we have had zero incidents and zero accidents," he affirmed.

While the company remains focused on its activity as a contractor in the Peruvian market, it has also sold machines to other countries, including Mexico. Blattner sees a good opportunity for Tumi's business in that country, considering softer ground conditions there that make raise boring more competitive.

METAL-MECHANIC INDUSTRY

With new copper projects under construction, metal-mechanic companies have also seen a boost in mining-related orders. Locally, this segment has also seen a significant merger between Esmetal and Imecon, completed in April 2019.

Diego Aguirre Salmón, general manager of Esmetal Imecon, explained about the strengths of the combined company: "As Esmetal we were the leading market player in metallic structures, and Imecon had other business lines that Esmetal did not have or that we were just in the process of incorporating, such as boilermaking, tanks and penstocks. Imecon also has more experience in electro-mechanic installation, civil works and EPC projects."

Aguirre Salmón affirmed that, unlike in previous years, mining now represents 60% of the business, considering that between 2% and 3% of the total capex in a mining project goes to the metal-mechanic industry. Esmetal Imecon has been providing the metallic structures for Mina Justa as well as the Toromocho expansion, while on the Imecon part of the business, it is manufacturing items for equipment players like Outotec, FLSmidth and Tecpromin, for both Quellaveco and Mina Justa.

Moving forward, Aguirre Salmón sees important opportunity in site-related projects, medium-sized EPC assignments and a wider range of metal-mechanic products and services. "With this merger, we become one of the strongest metal-mechanic players on the Pacific coast," he concluded.•

The Role of Innovation

Equipment manufacturers play a leading role in developing the technologies the industry will need in the future

The mining sector is not adapting to the digitalization era as fast as some industry insiders tend to think. For instance, while Komatsu introduced its first autonomous truck fleet in Chile at Codelco's Gabriela Mistral division in 2008, more than a decade later autonomous truck operations are far from being the norm – even in big mining. Meanwhile, in underground mining, the industry in Peru is still mechanizing many previously manual processes. When operators go for lunch, machines just stop working.

"The mining industry has historically been a bit of a dinosaur in terms of using technologies to transform the business," explained Suresh Vadnagra, president of MMG-controlled Minera Las Bambas. "We need to become much more rapid in adopting technologies. In the future, mining operations are going to be run in a very different way," he said.

In this context, the main original equipment manufacturers (OEMs) and technology developers have a lot to bring to the table, but mining companies need to dance to the same beat. For example, automation and digital features will be of no use if the mines do not have the right connectivity infrastructure in place.

"I cannot think of any element that should not be connected," said Franco Bulnes, country manager of Eaton. "The mines are already digitalizing many previously manual processes to reduce personnel and to handle all the data from the cloud. According to some estimations, by 2030 there will be 250 billion pieces of equipment online," he added.

THE DIGITAL MINE

Presenting at PDAC in March 2019, Anglo American Quellaveco's CEO, Tom McCulley, declared that he wanted Quellaveco to become a global point of reference in terms of mining technology. To achieve that, the company is being supported by a number of technology providers, including Siemens.

According to Gabriel Lelek, country lead for Digital Factory and Process Industries and Drives at Siemens, digitalization can take efficiency one step further than automation using SCADA. He provided a concrete example in mining: "Working together with the mining client and the mill manufacturer, we defined key performance indicators and analyzed cloud data for eight months. This allowed us to increase the mill speed without compromising any aspect in the process. With the savings achieved, the client could buy another mill to increase production."

The trend towards having digital mines is certainly in motion, but it will still take some time to reach full speed. Marcos Wieland, general manager of Sitech, the technology integrator branch of local holding company Ferreycorp, sees enormous room for growth in underground mining in particular, in areas such as ventilation on demand (VOD). Sitech represents different technology providers in areas like fatigue detection, vehicle weighing and fleet management. The issue, Wieland says, is still connectivity, considering the penetration rate of fiber optic is low in underground mining: "Our vision for the future is that all the equipment can go in and out of the mine, with all the information flowing smoothly. Today, this is still only a utopia scenario."

"To know what happened in the past is not bad, but it is not enough. You need to know what is going on right now, and for that you need connectivity, real-time data acquisition and transformation of this data in live information."

- Marcos Wieland, General Manager, Sitech

For Wieland, gathering data for the sake of it is not what the digital transformation should mean: "To know what happened in the past is not bad, but it is not enough. You need to know what is going on right now, and for that you need connectivity, real-time data acquisition and transformation of this data in live information."

To be able to do that, Sitech has created an industrial cloud, and in the future Wieland expects Sitech to make most of its sales from the provision of services rather than the sale of technology solutions: "The data are like streams that flow into a river, and the different rivers flow into the ocean. All the data needs to end up somewhere, so our vision is to integrate and handle all this information to have a better visibility of what is going on in an organization."

PARADIGM SHIFTS, BEYOND AUTOMATION

Local mining companies like Hochschild and Buenaventura have recently incorporated chief innovation officers to their teams to oversee this digital transition. "In urban areas we see the Internet of Things (IoT) and autonomous machines, and these concepts must be adopted by mining," said Víctor Gobitz, CEO of Buenaventura.

Ángel Tobar, general manager for the Andean region at Epiroc, a global OEM, explained that connectivity offers great opportunity for remote operations as well as for data acquisition and mine digitalization; however, he added that the transformation of mining is not exclusively based on these aspects, as the industry continues to rethink its current methods for extracting ore.

In this respect, continuous mining is shaping up as the way forward in the years to come, provided the technology continues to improve its performance: "The advantages of continuous mining versus discontinuous operations [drilling and blasting] are obvious, both in extraction and transportation," affirmed Tobar. "So far the technology available has been used for soft rock, like coal or potash, but we are already transferring that to semi-hard or hard-rock applications." Indeed, Epiroc's Mobile Miner equipment is already working in mines in South Africa, Australia and the United States.

The same goes for Wirtgen's surface miners, which are now offered locally by IPESA, a Peruvian distributor. Giorgio Mosoni, chief strategy officer at IPESA, outlined the advantages of this piece of equipment: "The surface miners can extract the different ore layers

"[With battery-powered equipment] you reduce drastically your ventilation needs. Moreover, electric engines incur lower maintenance costs, and you also achieve great savings in terms of all the logistics and transportation of diesel all the way to the mine."

- Ángel Tobar, General Manager, Epiroc

very accurately, foregoing the need for blasting and preventing the mix of ore with waste rock that happens in the shovels. The hardness of the rock is not an obstacle for these machines. The challenge is to design mines in a way that we can fully extract value from this equipment."

One key element in the mining equipment segment is the transition from internal combustion engines to electric and battery-powered equipment, with a view of reducing ventilation needs and increasing general efficiency. While just a couple of years ago there was a certain degree of skepticism about the performance of batteries, today it is widely accepted that battery-powered equipment will end up prevailing; the only question is when that will happen.

James Valenzuela, CEO of Resemin, a local manufacturer specialized in underground equipment for narrow-vein mining, related that the company should launch its first battery-powered jumbo this year: "This technology still presents some challenges, such as the price; these machines, just because of the battery, will cost between US$150,000 and US$170,000 more than the standard diesel-hydraulic machines. Battery prices are going down, from US$1,000 per kilowatt hour (kWh) to US$600/kWh, but they need to further decrease."

Epiroc has already been testing its battery-powered scooptram ST7 with several clients in Peru's underground mining space. Tobar acknowledged the capex for this technology is higher, but argued the total cost of operation is actually lower than with diesel equipment: "When doing a new mine design, you reduce drastically your ventilation needs; also, maintenance costs for an electric engine are lower. Moreover, in a country like Peru, you achieve great savings in terms of all the logistics and transportation of diesel all the way to the mine."

ADAPTING TO THE LOCAL MARKET

For multinational companies, it is essential to understand the dynamics of the local market and maintain close contact with headquarters so that the different models incorporate feedback from the final users.

Franklin Pease, general manager of Normet, a Finnish OEM mostly known for its shotcrete spraying machines, explained that the company is adapting to key developments in the Peruvian underground mining segment: "The trend is to move toward mechanization. Peru has made great progress in drilling with computerized equipment, also in scaling, and now we are going to see the mechanized charging of explosives, both for ANFO and emulsion."

Pease said that currently explosives charging is the "weakest link" in the whole mining chain, since it is predominantly done manually. "If all the process is mechanized, but you charge the explosives manually, you increase the risk of having deviation. Mechanized charging is an area where we see great opportunity."

Normet has around 20 models of its Charmec equipment for this task, adapting to different tunnel conditions and volumes required.

Also in this segment, and through collaboration with its local distributor Metal Técnica, Putzmeister has been modifying its mixers and shotcrete spraying vehicles to meet the needs of Peru's underground segment. José Midzuaray, general manager of Metal Técnica, explained: "Some mines are very narrow, some have very sharp turns or steep inclinations and some present strong dust and humidity conditions that damage electronic components […] Our mixers now include a hydrostatic speed regulation system for inclinations of up to 30%. We are introducing models for narrower veins, and we offer dual machines that can be diesel or electricity-powered."

Meanwhile, new safety regulations for underground processes in Peru impose the mechanization of certain jobs at height, such as rock scaling. Valenzuela of Resemin says that the company sold 12 scalers for narrow-vein mines just last year. Adding to the jumbos, scalers and bolters, Resemin now offers the full gamut of utility vehicles, with explosive chargers, vehicles to move personnel around, scissor lifts and platform trucks.

Pease of Normet noted that this mechanization trend demands from OEMs much more than just a wide portfolio of machines: "The challenge for us is that we need to train people for

the new mechanized processes, on top of having the right stock of machines, spares and all the associated logistics." In order to better respond to the more diverse demand coming from the market, Normet has increased its production capacity in Santiago, Chile, where it now assembles a wider product mix. "Latin America now requires more competitive lead times," Pease concluded.

CONSTRUCTION AND ANCILLARY EQUIPMENT

While the construction equipment market saw no growth in 2017 and 2018, there was at least no shrinkage despite the delay of several important infrastructure projects, largely thanks to the resilience of mining projects. Giorgio Mosoni of IPESA, a Peruvian company in charge of the distribution of Wirtgen Group and John Deere equipment, said: "2018 was a similar year to 2017, with a total market of 1,200 machines sold annually."

In recent years, IPESA has managed to grow awareness about the John Deere brand thanks to the creation of a sister company called CGM Rental, dedicated to construction equipment renting. IPESA has been driving equipment connectivity through the use of the JD Link system, which already monitors in real-time the health of over 40% of the 1,750 John Deere construction machines active in Peru. According to Mosoni, this model supports better customer service and complements the company's expanding physical network: IPESA is starting the construction of a new service hub in Arequipa, while in Lima it is investing US$15 million in a new logistics center.

In the trucks segment, the main players in Peru are Volvo, Scania and Mercedes-Benz, the latter being served through local distributor Divemotor. Beyond trucks, these brands also cover mining and construction activities with other vehicles such as buses for personnel transportation, and Volvo also has its own line of 'yellow' construction equipment including both the Volvo and the SDLG brands.

Jörgen Sjöstedt, managing director of Volvo Peru, outlined connectivity, automation and electro-mobility as some of the key industry trends the Swedish brand is working on. For instance, Volvo has carried out pilot tests with autonomous FMX truck models in Sweden, and the brand is already selling electric trucks in Europe. "We are putting the pieces together to determine when it makes sense to launch electric trucks in mining. Until then, we continue to improve the performance of our engines with a strong push for the Euro 5 fuel standard this year in Peru. Meanwhile, on the construction equipment side, we are going fully electric from 2020 in the compact excavators," Sjöstedt affirmed.

Lower emissions are particularly important in underground mining, considering ventilation systems can amount to 40% of total energy consumption in this segment. Scania, another Swedish brand, is also incorporating the Euro 5 standard across all its vehicles this year, even though Peruvian regulations only demand Euro 4. "This is part of our commitment to sustainability and to adapt to the conditions of underground mining," said José Antonio Mannucci, managing director of Scania.

The company has adapted its Heavy Tipper model, launched in 2017, so it can be used in underground mining activities. Juan Carlos Pon, sales manager of Scania, gave more details: "We have modified the driver cabins to be able to work in 3-meter tunnels without compromising the load capacity, which is 25% higher than standard dump trucks of the same category. The new Heavy Tipper can take up to 44 mt, and we want to launch a new version with even bigger capacity later this year. Additionally, this truck has a high-pressure engine that is 8% more efficient than the previous version."

In terms of connectivity, Mannucci explained the different applications of new technologies in trucks: "Beyond the geo-localization of the vehicle, we can measure operation cycles, driver performance and many other parameters. Also, we have launched a new concept of flexible maintenance, to make the most of each truck. Finally, connectivity is a key tool for safety monitoring and training."

COMPRESSED AIR SOLUTIONS

Mining processes require compressed air solutions across a wide variety of applications and international brands like Atlas Copco and Sullair are well established in the country.

Sullair air compressors, a brand recently acquired by Hitachi of Japan, are sold and serviced by Sullair del Pacífico in Peru. The company's main novelty for the Peruvian mining market is the ES-8 dual air compressor used in mining shovels. Richard Rodríguez, general manager of Sullair del Pacífico, explained how this new model allows for continuous operation: "With the ES-8 you have

Jörgen Sjöstedt, Managing Director, Volvo Perú

Richard Rodríguez, General Manager, Sullair del Pacífico

Francisco Kaiser, General Manager, TecProMin

a primary unit and a backup unit, and that prevents the shovel from having to shut down during maintenance."

Rodríguez said that air compressors cost a fraction of the price of large mining shovels or other critical equipment, yet they are essential to keep the operations running. "Air compressors can have a heavy impact on the performance of other machines that produce tens of millions of dollars; this is why the dual system makes total sense."

Rodríguez explained that, at a product level, the company will progressively incorporate connectivity and IoT tools thanks to Hitachi's technologies. At the Peruvian level, service is a key component, considering Sullair has an installed fleet of 7,000 machines. In this respect, the company has recently opened a service shop in Arequipa.

Meanwhile, Atlas Copco has consolidated its new structure in Peru following the Epiroc spinout. Vicente Trenado, its general manager, gave some examples of mining-related applications where Atlas Copco's compressed air solutions are used: "The Boomer machines have compressors on their chassis; many conveyor belts are operated pneumatically with compressed air and you see more compressors in the concentrators, be it in flotation cells or in separation and classification equipment."

Trenado commented that Atlas Copco has been in Peru for 69 years and has installed equipment in most of the large mining operations like Southern, Cerro Verde and Las Bambas, and now also Quellaveco and Mina Justa. In such large, energy-intensive operations, efficiency becomes a key driver, said Trenado: "Industrial processes rely so much on compressed air that in some countries this is already seen as the fourth utility, after water, power and gas. While compressors use significant amounts of power, Atlas Copco's units can reduce that consumption by up to 35%, realizing hundreds of thousands of dollars in savings."

One of Atlas Copco's latest innovations is the GA 160 VSD+ unit, a smaller compressor that allows for lower energy consumption and a smaller footprint. This, said Trenado, can be combined with the SMARTLINK connectivity system, therefore allowing for real-time, condition-based maintenance rather than standard preventative maintenance.

MINERAL PROCESSING AND HANDLING

For Fernando Samanez, VP Sales Mining Equipment at Metso, a mineral processing specialist, the market finally recovered in 2018 "after three difficult years." One of the latest milestones for the company has been the contract to provide Quellaveco with two SAG mills (40x25 feet) and two large ball mills (48x44.5 feet, similar to the ones being installed in Toromocho's expansion project). Also in Toromocho,

"The more we avoid human contact with the equipment, the better. A significant percentage of deaths in mining happen on conveyor belts, although this fact is not widely known. If you reduce maintenance needs, not only productivity increases, but also you eliminate a lot of risk."

- Javier Schmal, Managing Director Latin America, Martin Engineering

Metso is installing its 300 cubic m flotation cells, for a total of 14 cells in this copper mine. Metso has actually developed a design for a 660 cubic m flotation cell, although this is still not working at a commercial level.

While there is an effort by plant OEMs to standardize equipment sizes and types, this is still difficult to achieve in big mining, said Samanez: "For large-scale, the equipment is still tailor-made. Engines vary a lot depending on altitude, for instance. The equipment adapts to the tonnage of each mine, with ad-hoc structural design. Standardization is more suitable for brownfield projects, since it helps the client reduce lead times to just four or five months," he explained.

At a Latin American level, a focus on tailor-made engineering has helped TecProMin grow in the market. TecProMin combines its in-house capability to design systems such as reagent preparation plants (including milk of lime preparation plants) and ore sampling systems, with the representation of different brands for items such as ball mills, vertical mills, thickeners, agitators, filters and water treatment solutions, among others. "Our focus has been on meeting the clients' needs and not on the mere sale of equipment," said Francisco Kaiser, general manager of TecProMin.

Through its presence in Chile, where TecProMin was founded 35 years ago, the company's systems handle the sampling of 81% of this country's copper exports, according to Kaiser; in Peru, where it was established 12 years ago, those are already working in Impala and Perubar. Elsewhere in the mining process, TecProMin has designed milk of lime plants for Escondida, Quellaveco and the Toromocho expansion, with the incorporation of Eirich or Cemtec mills.

On the water treatment side, TecProMin works together with BQE Water of Canada, and looks at approaching water treatment as a profitable endeavor: "BQE Water has solutions to extract undesired metals and non-metals from the process prior to neutralization; if there is enough concentration, this could generate a marketable product and provide income that will pay for the subsequent water treatment process. Water treatment has always been seen as an expense, yet this approach could be a game changer," assured Kaiser.

On the global OEMs like FLSmidth or Thyssenkrupp, which was recently awarded a 4.7-km belt at Quellaveco, miners have other options for material handling such as DIMISA, a Mexican company with manufacturing facilities in Monterrey.

While the Mexican and U.S. markets were the natural markets initially, DIMISA soon expanded southwards into mining projects in Central America, and seven years ago it opened an office in Lima to supervise its first project in the country. "Back then we installed several conveyor belts at Toquepala, and more recently we also participated in Toquepala's expansion with a total of 34 systems, mostly conveyors but also six apron feeders. We also provided Fluor with 30 feeders for the Cerro Verde expansion," related José Luis Herrera G., general manager of DIMISA Perú.

DIMISA has traditionally served many clients in the cement industry, yet Herrera said mining projects require much larger equipment: "In mining we see 72 inch or 96 inch wide conveyors. In cement or steel plants, the larger conveyors are 42 inches or 54 inches wide."

Considering the sheer size of mining facilities, there is significant opportunity for companies that provide the necessary components and support to ensure all infrastructure works smoothly. Martin Engineering, for instance, offers a line of conveyor products that focuses on reducing product leak, pollution levels and safety risks for operators. For Javier Schmal, managing director Latin America at Martin, the safety aspects around conveyors are trickier than they sound: "The more we avoid human contact with the equipment, the better. A significant percentage of deaths in mining happen on conveyor belts, although this fact is not widely known. If you reduce maintenance needs, not only productivity increases, but also you eliminate a lot of risk."

On top of its conveyor solutions, Martin also offers air cannons to assure the right product flow, as well as industrial vibration solutions. Martin works with a wide range of mines in Peru, from large copper operations to medium sized precious metal or polymetallic mines, therefore adapting to the different ores is key, said Schmal: "Sometimes you need different solutions within the same mine. We have different types of urethanes, steels and coatings to provide the best alternative, and our R&D department in the United States works together with the engineering departments of each of Martin's subsidiaries. For instance, at Mina Justa, we have developed a special type of coating to solve some corrosion issues related to the mine's process."

Finally, Industrial Yale Perú (YALEPERU) is a local player specialized in wear solutions that started 10 years ago. Its first activities coincided with the mining boom and, as larger providers focused on big mining clients, YALEPERU grew rapidly in the small and medium-sized mining segment.

YALEPERU combines fabrication capabilities using rubber, polyurethane and ceramics and, more recently, it has expanded to provide metal-mechanic fabrication as well. Today, the company has already entered the big mining segment, with ISO 9001 and OHSAS 18001 certifications, and its range of products covers mill liners and other wear items for SAG mill trommels, crushers, flotation cells and screens, among others. Nilo Martínez Vargas, general manager of YALEPERU, elaborated on the company's recent investment in metal-mechanic capacity: "We can now fabricate rubber and polyurethane-lined spools and metallic components. We have acquired an autoclave with the latest technology for vulcanization to obtain the best rubber, ceramic and metal adherence, and we also have a machine for centrifugal polyurethane spool lining."

The company is also aiming at increasing its range of action toward the larger equipment, said Martínez Vargas, who explained that soon YALEPERU will be able to offer large hybrid (rubber/metal) liners for the large mills.▪

Mining Services

Investment in technology is driving efficiency across contracts

Photo courtesy of Geotec

During the crisis, cost-cutting initiatives across mining operations became commonplace, and these moves created enormous pressure on providers to reduce costs. While this had the positive effect of making the industry lose some fat, some of these initiatives were counter to overall efficiency, such as shortening service contracts too much. The rationale was that, with a short contract, the provider would not rest on its laurels, or it could lose the upcoming bid to a cheaper competitor.

Particularly in drilling, the crisis caused a collapse of the price per meter. When the market touched bottom, miners started to offer long-term contracts to contractors, probably anticipating that prices would go up as soon as the mining cycle picked up.

A less Machiavellian reading of this trend suggests that mining companies wanted providers to incorporate the latest technology for productivity and safety. Take Geotec, for example: the company spent US$12 million in 2018 on new equipment, with the support of three-year drilling contracts with both Las Bambas and Yanacocha, amounting to 12 rigs each. With 240 people, the Las Bambas contract is probably one of the largest drilling contracts worldwide, said Miguel Ángel Arenas, general manager of Geotec: “Long term contracts allow us to renew our fleets and to invest in hands-free technology, following the industry trends. Today, the market is moving toward smaller rigs, as well as automation,” he explained.

These investments in technology have not caused the rate per meter drilled to go up, however. Arenas said: “The market is not ready to pay a big difference to incorporate this technology, although automation brings higher levels of safety and productivity, which pays off the initial investment.”

AVOIDING PRICE WARS

Jorge Granda, general manager AK Drilling International, a contractor with operations in five countries, lamented that during the crisis the market was heavily driven by price. “A number of companies have looked for market positioning based on a low-price strategy. We had to adjust our rates in some instances, but overall we focused on service quality.” As part of this, Granda added, AK Drilling expanded its diamond and RC drilling fleet, while it renewed its triple certification for the water well drilling service.

Speaking of the introduction of new technologies, Granda said that the ball is largely in the client’s court: “These technologies demand large expenditures, so if you have a market that is just looking for cheap drilling, it is risky to invest in them. The client must understand the value of quality service and the investment the contractor needs to make for this, rather than just considering the lowest price possible. In the long run, you get what you pay for.”

To add value, many contractors are doing their own technology development. Geotec not only uses standardized third-party rod handlers, like Epiroc’s Christensen models, but is also developing its own rigs, together with Safedrill of Chile. As an example, for Las Bambas, they have developed a modular rig with a smaller footprint of just 15x10 m. The rig is 100% hands-free, has its own mud treatment plant that eliminates the need for excavating mud ponds and can drill holes of 2,000 m in depth.

LABORATORIES

Key players in laboratory analysis also need to up their game in order to avoid the commoditization of their service. In Peru, both local players, like Certimin, and international companies, like SGS, are implementing different strategies to add value, notably

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- Mario Matuk, General Manager, Exsa

the incorporation of new technologies and a stronger focus on geo-metallurgy, which involves the integration of geology and metallurgy by undertaking metallurgical tests from the moment exploration samples are sent to the lab.

Miguel Caillaux, managing director of Certimin, lamented that the industry has been focusing just on obtaining the lowest rates, in a time when some global labs are engaging in price wars to gain market share in Peru: "In recent years, we have reached predatory rates that do not even cover the cost of good quality service. We see ourselves as a boutique lab that offers personalized service, yet clients make you feel that price is what matters, with logistics managers replacing technical personnel and taking the final decisions solely based on price."

To offset that trend, Certimin has been offering clients a more comprehensive approach to cover the full cycle of geology and metallurgy. Caillaux added: "Every metallurgical project is a mystery, a true research project. We offer flotation, leaching, gravimetry and magnetic separation tests, among others. We have an automated 24-cell pilot flotation plant where we can work with very small volumes of just 10 to 15 kilograms per hour. This means that 1.5 mt is more than enough to carry out a representative test."

Meanwhile, SGS is also pushing for the geo-metallurgical approach. According to Ernesto Labarthe, manager of the Minerals division at SGS in Peru, the country has a long way to go in this respect: "In Chile and North America, clients see geology and metallurgy as a package; it is unconceivable to work these aspects separately. In Peru, we are organizing seminars to push for this trend and to show how clients can save extra drill holes by implementing an integrated approach toward core samples."

Labarthe related that SGS is working on new software in Peru that would allow the client to follow up the status of their samples on real time. "Through a smartphone app, we can set up alerts when the sample is picked up in the field, or when the laboratory test starts. This is an in-country development, and the app will be ready during 2019," affirmed Labarthe.

BLASTING

As in the drilling segment, pressure on rates and shorter contracts were also seen in the explosives market during the crisis. For Mario Matuk, general manager of Exsa, a blasting solutions company, this had negative consequences: "The problem with short contracts lies in the learning curve. We are talking about remote deposits and complex facilities, and if the timeframes are too short, the process will not be optimized."

Today, the trend in blasting is to have at least three-year contracts, but the market continues to be very competitive, including large players such as Exsa, Orica, Famesa, Enaex and Maxam, while EPC Groupe of France is also setting up shop in Peru. For Matuk, the key component for blasting solutions players is to demonstrate value: "While explosives consumption is very high in Peru and mining projects continue to develop, the clients need to perceive value in aspects such as the mine-to-mill performance and the overall impact of the explosive on their bottom line."

For Exsa, open pit mining represents 60% of its revenue. In this segment, its Quantex technology has played a key role in helping the company grab a 40% market share, and recently Exsa was awarded its first contract in Chile using Quantex. Meanwhile, underground mining accounts for 30% of the company's revenue; the latest development in this sector is the introduction of Quantex SUB, a pumpable gasifiable emulsion that offers better progress per blast, less overbreak and lower dilution, while also requiring less ventilation, according to Matuk. Finally, initiation systems represent the remaining 10%.

Looking at the future, Matuk of Exsa gave an indication of how the blasting market may grow in Peru: "New projects require explosives for early works – we estimate that Quellaveco and Mina Justa are already generating 3% to 4% growth in 2019. Once they enter production, we should reach double-digit growth."

In light of this expansion, it is no surprise that Peru's mining industry is attracting new players into the blasting segment. As previously noted, multinational company EPC Groupe recently decided to enter Peru, and it is setting up a local facility to produce explosive products. However, the company's initial strategy is to attack the market through a services company – a 50-50 joint venture with underground contractor IESA, called EPC Servicios Perú.

"New drilling technologies demand large expenditures, so the client must understand the value of quality service and the investment the contractor needs to make for this, rather than just considering the lowest price possible."

- Jorge Granda, General Manager, AK Drilling International

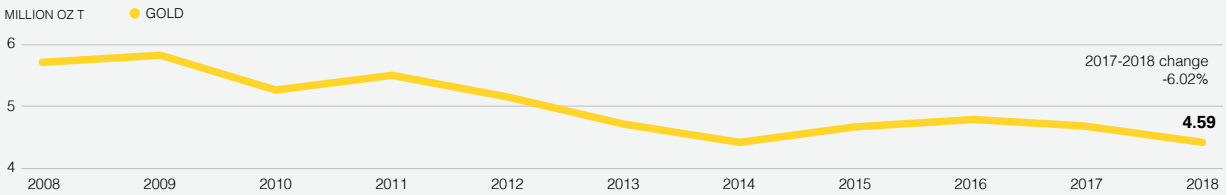
EPC Servicios Perú wants to capitalize on the opportunity generated by the mechanization of processes in underground mining, said its business development manager, Armando Picoy: "90% of processes in underground mining are already mechanized, yet blasting is still done using manual methods. Our vision, together with IESA, is to adapt our technologies in explosives and blasting engineering to mechanize 100% of underground processes."

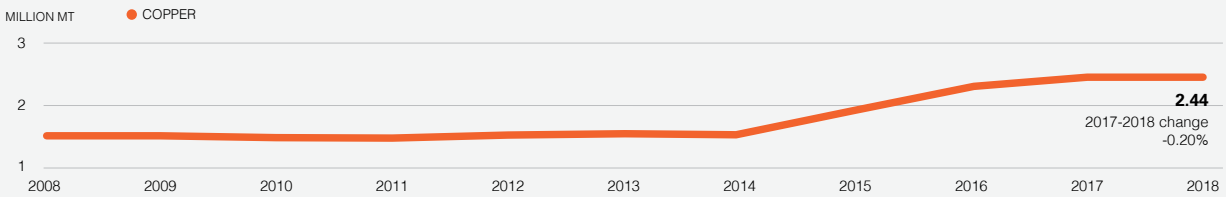
For this, EPC Groupe has developed smart modules for the charging of pumpable gasifiable emulsions, with the idea of improving productivity, safety and environmental performance. "Looking back one decade ago, dynamite accounted for 70% of the underground market; today, the market has migrated toward packaged emulsions, yet these still require manual work. We are going to offer our technology to mechanize charging and blasting processes."

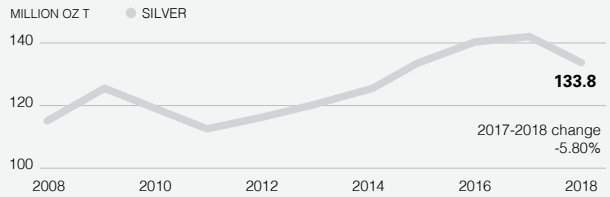
EPC has operations in 40 countries and has its own software for blasting engineering in open pit mines called Expertir. The focus of the Peru operation will be underground to start, and the company is already working on an underground version, under the name of Smart UG.•

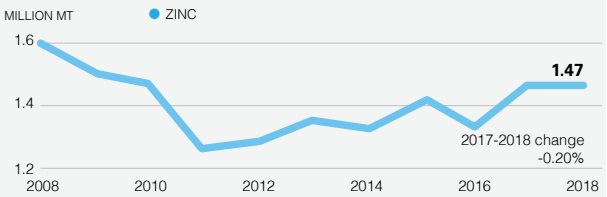
PERU, A DIVERSIFIED METALS PRODUCER

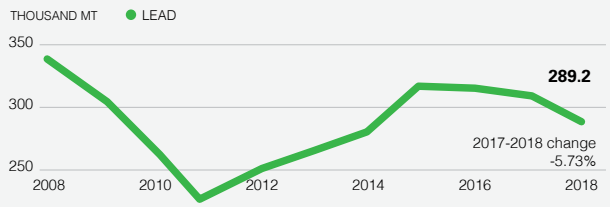
Source: Ministry Of Energy And Mines / GBR

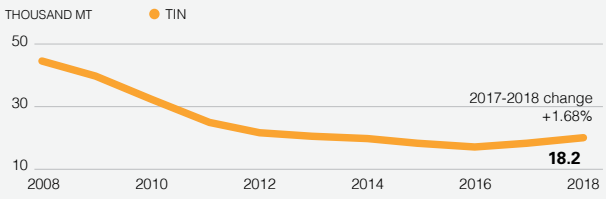






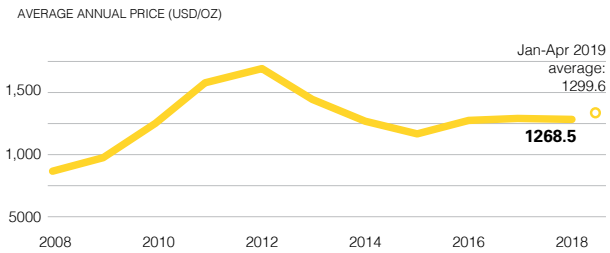






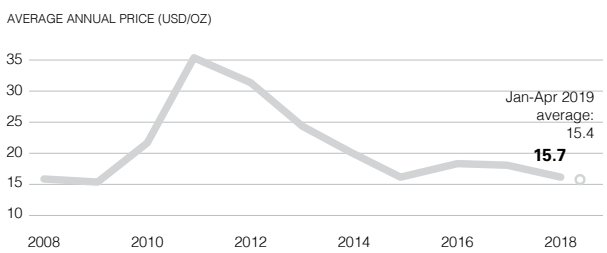
GOLD PRICE

Sources: KITCO / GBR



SILVER PRICE

Sources: KITCO / GBR



ZINC PRICE

Average official LME price, Cash Buyer

Sources: LME / GBR

	US$/MT	US$/LB
2016	2,090	0.95
2017	2,893	1.31
2018	2,924	1.33
2019 (Jan-Apr)	2,703	1.23

COPPER PRICE

Average official LME price, Cash Buyer

Sources: LME / GBR

2018	US$/MT	US$/LB
2016	4,863	2.21
2017	6,162	2.80
2018	6,525	2.96
2019 (Jan-Apr)	6,277	2.85

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GLOBAL BUSINESS REPORTS

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