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Pre-release Edition

Peru's Mining Industry Grows on Autopilot

The country's mining sector isolates itself from the political noise to continue promoting its mineral production

In March 2018, in his capacity as Peru's vice-president, ambassador to Canada and former governor of the Moquegua region, Martín Vizcarra gave a talk at the PDAC Convention. During his speech, he outlined the successful public-private collaboration that led to the development of the Quellaveco copper project by Anglo American. The audience listened with excitement because they knew they were likely to be sitting in front of the next president of the country; at that point, the then head of state, Pedro Pablo Kuczynski ("PPK"), was under fire due to the Odebrecht corruption scandal and other internal matters. PDAC was indeed one of the last public appearances by Vizcarra before becoming the country's president on March 23, 2018, following PPK's resignation. While the new administration failed to end the political noise during the first months of Vizcarra's tenure, the new president finally cornered the opposition-controlled Congress with a referendum whereby nearly 86% of Peruvians voted in favor of banning the re-election of parliamentarians. This was seen as a popularity boost for Vizcarra in his attempts to move government initiatives forward.

In parallel to all this, and with the exception of public infrastructure projects that were affected by corruption and scandal, economic activity continued in the country. The mining industry, empowered by better commodity prices and the general restart of activity that is typical of mining cycles after a downturn, was no exception. 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 between US\$5 billion and US\$5.3 billion. On top of these investments, Shougang and Southern Copper completed their respective expansion projects at Marcona (iron ore) and Toquepala (copper) during 2018 as well. Putting figures into perspective, total mining investment amounted to US\$4.95 billion in 2018, according to the latest information released by the Ministry of Energy and Mines (MEM). This represents close to a 26%

increase over the US\$3.93 billion investment in 2017 (a year ago, MEM had published that mining investment in 2017 was US\$4.92 billion, but this has been revised since). While the expectation for 2019 is quite positive, with official estimates to reach around US\$6 billion, these amounts still lag behind the record investment figures of the super-cycle period between 2011 and 2015, where the annual average was around US\$8.4 billion.

REALIZING THE COUNTRY'S POTENTIAL

While no one expects a commodity boom like the one of those years, an old theme persists, and this is that Peru could fare much better in terms of project development. Luis Rivera, president of the Peruvian Institute of Mining Engineers (IIMP in its Spanish acronym), 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," Rivera continued, referring to the regional and local elections held in Peru in October 2018. "There is political noise in some regions, 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 a matter of just a decade, between 2007 and 2016, positioning itself as the world's second largest producer after Chile, and the country continues to have a very promising pipeline of copper projects. In a context of higher demand for copper due to global electrification, this is an enormous opportunity for Peru to keep promoting its mining industry.

Furthermore, major gold companies have started what is seen as a new wave of mergers of acquisitions, led by the Barrick-Randgold and the Newmont-Goldcorp combinations. Peru is the sixth largest gold producer according to the United States Geological Survey (USGS, 2017 data), and ranks seventh in terms of reserves so, again, the country's geology is not under question – Peru just



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needs to promote an environment that is business-friendly enough to attract those companies that not only have the financial capacity to take projects into production, but also operate with the highest environmental and social standards.

Víctor Gobitz, CEO of Peruvian precious metal miner Buenaventura, commented on the latest M&A activity in the gold segment: “These transactions are a result of the increased difficulty to find large deposits in the gold industry, and of the more stringent regulations that make it harder to develop new projects. The price of gold reaching more than US\$1,300 per ounce is also a consequence of this situation.” Asked if Buenaventura, one of Peru’s largest mining companies with a market cap of over US\$4 billion (February 2019), could engage in inorganic growth, Gobitz was cautious: “The recent tailings dam disaster in Brazil must make mining companies think before making acquisitions. At some point Vale grew a lot through M&A, but when you buy an asset, you also buy its liabilities,” he said. While the company does not rule out acquisitions, especially within Latin America, Gobitz referred to Buenaventura’s wide project portfolio in Peru as the main focus of the company for now.

CREATING CLUSTERS

Looking at the future of copper production, the country envisions more multi-billion dollar investments to continue closing the gap with the red metal leader, Chile. Pablo de la Flor, executive director of the

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CEO,
Buenaventura



National Society of Mining, Petroleum and Energy (SNMPE in Spanish), noted that Peru has a portfolio comprising 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. While Peru is probably a couple of decades behind in its mining development with respects to Chile due to the political instability of

the 1970s and 80s, this can be seen as an opportunity, as 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.

One of the main objectives ahead is the creation of mining clusters, where providers can set up efficient service shops close to the mining operations, and where miners can share certain infrastructure. A move in this direction has already been taking place in the Arequipa region, with the large copper production coming out of southern Peru.

Luis Rivera, president of IIMP, gave more details about this: “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 receive 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 still room for more industry integration in the area with the development of the large Las Bambas copper district in Apurímac. Also, to 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, a processing plant or a 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.

Of course, for this to happen, the State needs to play a key role to coordinate the different projects, develop the underlying infrastructure and collaborate 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 Apurímac 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 infrastructure? It is a catch-22 situation. Whatever way we look at it, this requires significant coordination between the various parties.”

A PLAN FOR 2030

In recent times, industry leaders have been pushing government authorities to develop a long-term vision of the industry that goes beyond the individual mandates of the different governments. Looking back, the mining ministers lasting more than two years in office have been the exception, and the last four have held office for less than a year each.

In August 2018, the Martín Vizcarra government created the so-called Center of Convergence for Good Mining and Energy Practices. Beyond its pompous name, the objective of this body is to define a strategy to develop the country’s project portfolio by 2030, in a timely and sustainable manner.

This includes several pillars, from the promotion of investment to the articulation of State institutions in the areas of influence, in order to close gaps in economic inequality and infrastructure. Carlos Gálvez of PERUMIN, however, concluded that these objectives need to translate into real action: “The mining industry is a key strength for Peru: it represents 11% of GDP, 60% of exports and 20% of all taxes collected by the State. Now, we need president [Vizcarra] to take a leadership role, with a vision for the country and a strategy to meet it, taking advantage of his relationship with the regional governments to persuade the population of the need for mining investment.”



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It just happened again: three years after the Samarco (Vale/BHP Billiton) tailings dam failure, which is considered to be Brazil's worst environmental disaster ever and claimed the lives of 19 people, in January 2019 Brazil suffered yet another catastrophic event with the burst of the Brumadinho tailings dam at Vale's Córrego do Feijão iron ore mine. While the volume of the waste flow was lower than in Samarco (12 million cubic meters versus 60 million cubic meters in 2015), the latest incident caused a horrendous death toll: by February 14, 2019, 166 people were confirmed to have died, while a further 147 people remained missing. Most of the victims were Vale workers. The implications of these events cannot be taken lightly, as they deeply affect the relationship of the mining company with all its stakeholders: the workforce, the surrounding communities, the authorities, and Mother Nature. If in the past it was enough to focus on the technical aspects of a project to move it forward, today other ingredients have become indispensable components of a project's

success: political and social acceptance, environmental stewardship and an uncompromised commitment to safety.

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 the ones 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 to the construction stage, the aforementioned projects on stand-by are still to see the light. Southern Copper spokesmen regularly make statements about their will to put Tía María into production as soon as possible, but Newmont seems to have abandoned Conga until further notice.

Oscar Díaz, CEO of Viceversa Consulting, a specialist firm in environmental and social services, drew a comparison between successful and failed projects: "Quellaveco is an excellent example

of how working for 18 months on the social aspect is not a waste of time. Tía María did not follow the same path, and even if it had its EIA approved at some point, it has now been on hold for nine years."

For Díaz, the challenge for Southern Copper is that it has to work not just on obtaining the social consent, but also the political consent. "If the authorities do not support your project, not only will they not help, but they will also become an obstacle," he affirmed.

By and large, the industry should be able to work well with the new regional leaders elected in October 2018, perhaps with the exception of the Puno region, where Walter Aduviri was elected as governor. Back in 2011, Aduviri led violent protests that ended with six deaths, while 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.

Having said this, not only Puno raises some questions with respects to mining development. The new governor of Arequipa, Elmer Cáceres, has shown its 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 introduce a new scenario and companies need to rebuild their relationships," explained Díaz, who 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 to work with the main candidates before the elections."

For Jorge León Benavides, leader of the Peruvian delegation to PDAC at the Canada-Peru Chamber of Commerce, some of the new regional governors that have shown their reluctance to promote the industry are not categorically anti-mining, but rather "they do not understand the problems of some particular projects." As part of the Chamber's initiatives during the PDAC gathering in Toronto, invites are sent to

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



several regional governors to fly to Canada. "PDAC is like a World Cup where the different jurisdictions showcase their strengths, and we always invite regional governors and mayors from the mining areas. This is very important, especially now that we have new authorities, so they can see in person how difficult it is to attract investment," he said.

CONTRIBUTING LIKE GOOD NEIGHBORS

Getting a project to the stage where it has all necessary permits as well as the 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: if 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 what their area of influence is," explained Díaz of Viceversa.

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“Regional and local elections introduce a new scenario. Companies always wait for the results of the polls, but they should work with the main candidates before the elections.”

**-Oscar Díaz,
CEO,
Viceversa Consulting**

For León Benavides, Peru cannot afford to have a 20% poverty rate when the country has such a rich geological endowment: “Our GDP needs to grow by at least 7% or 8% annually to tackle poverty rates, and for that the country needs mining.” Numbers on the contribution of the mining industry to the economy speak for themselves, according to executive director of the National Society of Mining, Petroleum and Energy (SNMPE) Pablo de la Flor: “Over the last decade, the industry has transferred nearly 40 billion soles (PEN) to the regions, and the industry accounts for nearly 20% of

all the taxes collected by the country.” The problem, then, is about the perception of the population living near mining operations. De la Flor continued: “The perception of people in the mining regions is that the wealth created by the industry is not fairly distributed. Therefore, the mining canon needs to be reworked.” The mining canon is Peru’s tax distribution tool whereby 50% of the income tax paid by the mining companies is sent directly to the areas of influence. The mechanism presents a problem, namely that regional and local authorities often do not have the capacity to spend that money on

the right projects that could address the basic needs of the population in terms of health, nutrition, education and infrastructure. Partly to address these shortcomings, Peru has been promoting the ‘Works for Taxes’ program in recent years, where private companies contribute their project management capacity to invest directly in particular infrastructure projects, rather than just transferring the taxes to the State. Through this program, mining companies have contributed to the development of relevant infrastructure such as bridges, hospitals, irrigation canals and police schools, to name a few. What is clear is that the industry cannot turn a blind eye to the problems of the population around its operations. For Oscar Díaz, a company investing hundreds of millions of billions of dollars in an area cannot only pay attention to the resource beneath the surface: “Operators know about the copper, the silver or the oil, but they must also be aware of the history of the people in the area, their educational level, their concerns, and their economic and health situation.”

Suresh Vadnagra, president of Minera Las Bambas, reflected on how the company wants to work with the new regional authorities in Apurímac: “It is important to build strong and sustainable relationships with the new authorities, understanding their views and aspirations and learning how we can contribute towards their development goals for the region. One of the key challenges for Apurímac 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.

Indeed, it is still 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 development at both the macro and micro levels.

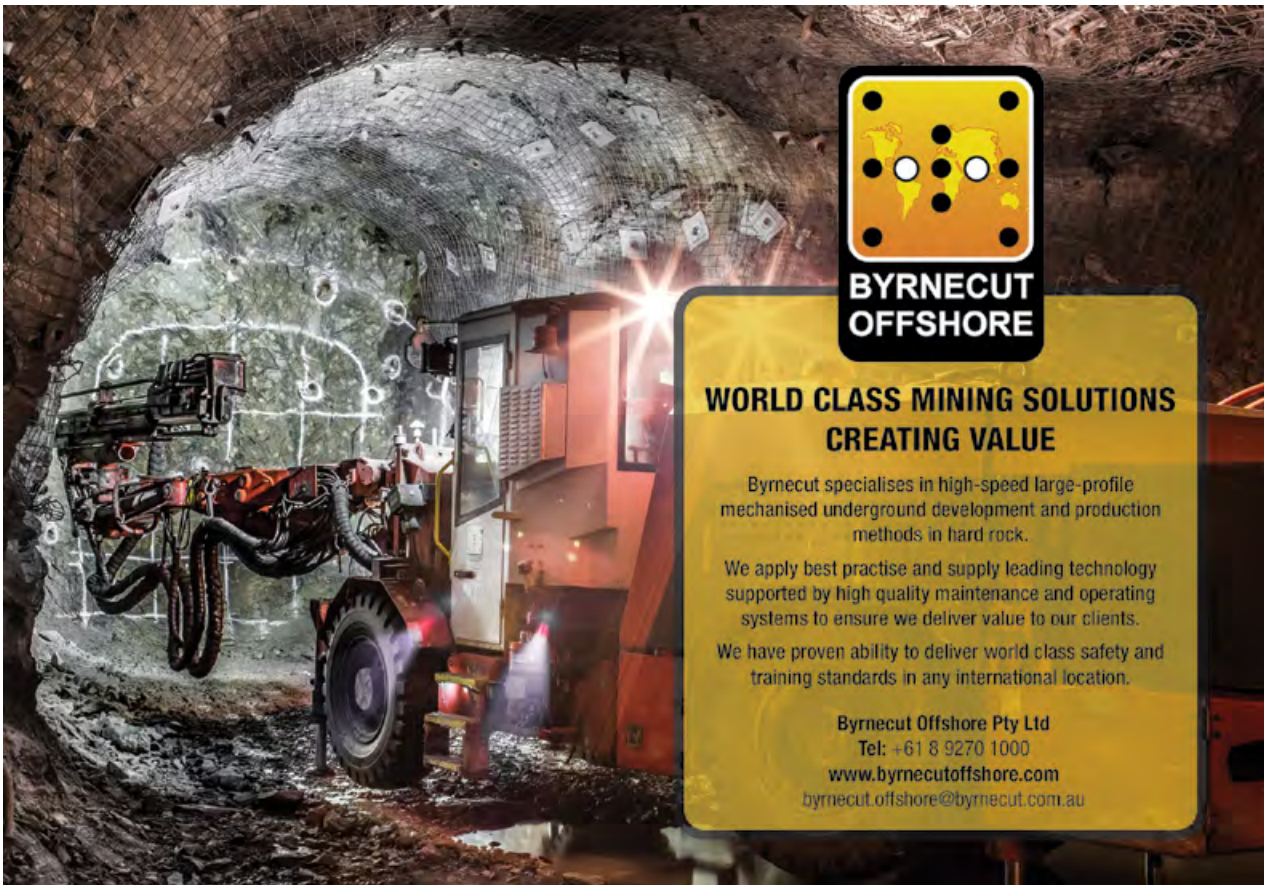
Mining Production

Peru’s copper output remained stable in 2018, but new greenfield and expansion projects will add new capacity soon

2018 saw no significant changes in Peru’s copper production. With an annual total just short of 2.44 million tonnes (mt/y), the figure actually represented a slight decrease of 0.4% year-on-year. The country should see an important increase in volumes in the coming years, however. For starters, Southern Copper has recently completed the expansion at Toquepala, that is adding 100,000 mt/y, while Chinalco’s expansion of Toromochó should yield a 45% increase in copper production at that operation; Minsur’s Mina Justa, under construction, will add 100,000 mt/y of copper, including 58,000 mt 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 in between Toquepala and

Cuajone; Chinalco, with 208,300 mt/y at Toromochó; 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%). Meanwhile, Las Bambas had an issue related to wall instability at the Ferrobamba pit that caused output to decrease in 2018, yet company sources assure that this does not change the long-term projections for the operation. Indeed, 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 for 2019 is between 385,000 and 405,000 mt/y.

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 and increase throughput by 5 to 10% over the next few years."

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." On top of these large open pit copper operations, Peru offers copper production from medium-sized underground mines as well. These include El Brocal, an operation controlled by Peruvian miner Buenaventura, that yielded 47,300 mt/y; Cerro Lindo, the largest operation by Brazilian company Nexa Resources (formerly Milpo-

"Between Ariana and the Condestable expansion we will move from 23,000 mt/y Cu eq to 42,000 mt/y Cu eq, and our combined all-in cash cost will go down to US\$1.12/lb. That will put us in the first quartile of costs of copper producers."

**-Adolfo Vera,
president and CEO,
Southern Peaks
Mining**



Votorantim), that produced 39,800 mt/y; and Condestable, operated by private company Southern Peaks Mining, that 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.

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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 tonnes per day (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.

Beyond this expansion, Southern Peaks is also adding a new operation to its portfolio, the Ariana mine located in Junín, which is already under construction. Ariana has 16 million mt of resources (including 13 million mt of reserves), and will initially process 2,000 mt/d, with the idea of expanding the plant modularly afterwards.

Vera summarized how these developments will strengthen the company's position: "Between Ariana and the Condestable expansion we are moving from the current 23,000 mt/y copper equivalent to 42,000 mt/y copper equivalent. More important than this is that our combined all-in cash cost will go down from the current US\$1.54 per pound (US\$/lb) to US\$1.12/lb. That will put us in the first quartile of costs, typically populated by the large open-pit mines."

PRECIOUS METALS

Buenaventura (BVN) 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 ounces in 2018 (oz/y), 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 Toromochó. 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.

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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 about this program: "We are improving the lifting, dewatering and ventilation infrastructure, while we are 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."

"Sometimes," Gobitz continued, "we prepare mining blocks every 50 meters due to the lack of information, but if we could prepare blocks every 100 m or even every 200 m, we would dilute the cost of the infrastructure. Finally, we are centralizing the operations. Sometimes, if you just look at production you lose the right focus, which should be on cash generation."

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, the former Chucapaca project acquired from Gold Fields in 2014, which is 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 from Yanacocha), Tahoe Resources (243,000 oz/y between La Arena and Shahuindo), Aurífera Retamas (201,300 oz/y), Consorcio Minero Horizonte (182,900 oz/y), Hochschild Mining (181,200 oz/y, mostly from Inmaculada), and

Gold Fields, with 157,800 oz/y from Cerro Corona.

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. Last year, Gold Fields announced it was extending the life of the mine from 2023 to 2030, despite the limitations the operation has in terms of footprint.

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 in 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."

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 this metal 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.

Finally, lead production reached 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.

"No other industry can attract billions of investment for remote areas"

Luis Rivera
President,
Peruvian Institute of Mining
Engineers (IIMP)



How is Peru perceived as a mining jurisdiction, considering the recent investments in Quellaveco and Mina Justa?

According to S&P, Peru is the fourth largest recipient of exploration expenditures with 6% of the total. With 1.3 million square km, Peru is small if compared to continent countries like Canada, the United States or Australia; yet, Peru has all the important metals: copper, gold, silver, zinc, tin and additionally iron, vanadium and lithium. Moreover, 60% of our energy matrix comes from clean sources and offers competitive costs. What we do not have, however, is political stability. There is political noise in some regions, 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.

How is the industry working on its image?

We need to reach out to the wider population, especially all those people that see mining as something distant. 60% of the country's foreign currency is generated by the industry, and 1.2 million people are directly or indirectly employed by the sector. No other industry can attract investments worth billions of dollars, and that money actually goes to remote areas where it is needed the most.

What is being done to remediate environmental liabilities?

Past environmental liabilities are managed in Peru by state company Activos Mineros, but the legislation presents many inconsistencies. At IIMP we are preparing a proposal for a regulatory plan to close these gaps and to promote environmental remediation by the private sector. In total there are 8,000 environmental liabilities in Peru, but many of them are different items within a particular mining site. Therefore, it would be more rational to come up with a more accurate classification, and within that to identify those liabilities that present critical risk.

How is Arequipa shaping up as a mining cluster?

We are working with the Andean Development Corporation (CAF) and the Arequipa Chamber of Commerce to produce statistics on production and logistics in the area, considering that a mining cluster already exists in Arequipa with the large copper mines in the south. 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 the industry. Meanwhile Uchumayo, Majes and La Joya are transforming into industrial service hubs for the sector.

After increases in 2016 and 2017, mining fatalities reached a record low in 2018. Why is this?

Over the last 20 years, we have seen a direct correlation between commodity prices, especially copper, and the number of fatalities. Luckily, in 2018 that trend was reversed. Mining companies are changing for the better, notably medium-sized and small companies that work underground, as they adopt the best practices of the major international operators.



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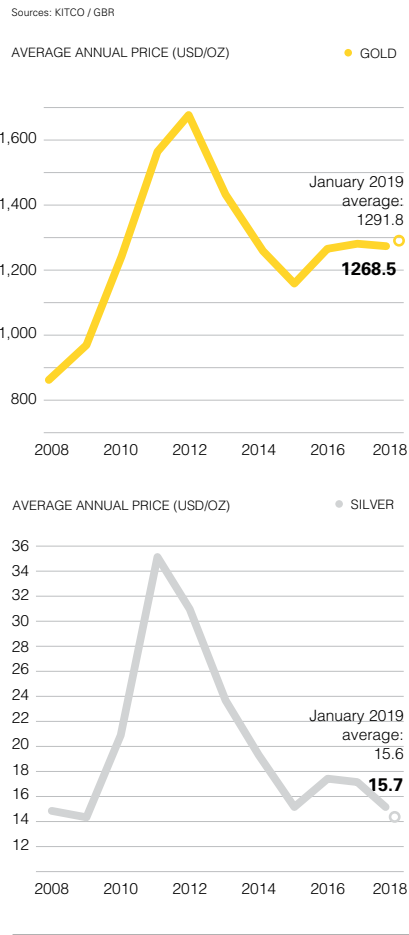
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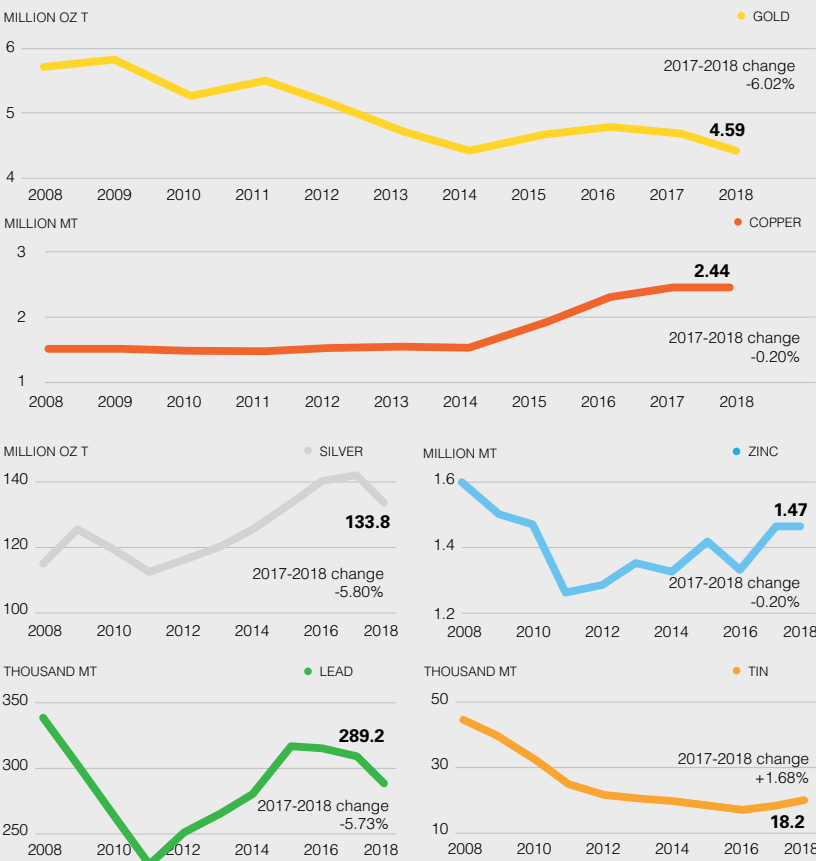


GOLD AND SILVER PRICE CHARTS



PERU, A DIVERSIFIED METALS PRODUCER

Source: Ministry Of Energy And Mines / GBR



ZINC PRICE (MONTHLY AVERAGE)

Average official LME price, Cash Buyer

Sources: LME / GBR

2018		\$/MT	\$/LB
January		3,446	1.56
February		3,539	1.61
March		3,280	1.49
April		3,190	1.45
May		3,058	1.39
June		3,092	1.40
July		2,659	1.21
August		2,510	1.14
September		2,432	1.10
October		2,671	1.21
November		2,592	1.18
December		2,624	1.19
2019	January	2,558	1.16

COPPER PRICE (MONTHLY AVERAGE)

Average official LME price, Cash Buyer

Sources: LME / GBR

2018		\$/MT	\$/LB
January		7,079	3.21
February		7,001	3.18
March		6,795	3.08
April		6,838	3.10
May		6,822	3.09
June		6,955	3.15
July		6,248	2.83
August		6,039	2.74
September		6,019	2.73
October		6,215	2.82
November		6,192	2.81
December		6,093	2.76
2019	January	5,931	2.69

Peru's Junior Segment

Juniors have good projects to work on, but continue to suffer costly delays to obtain their 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. Bill Pincus, president and CEO of Miramont Resources, a junior company active in south-eastern Peru, provided a snapshot of the most recent market sentiment: “2018 was quite challenging, with junior exploration

companies facing a lot of competition for investors from the marijuana and blockchain/cryptocurrency industries as well. I think a lot of that has turned into a bust, and there is more interest from high-risk investors in junior exploration this year,” he said. Jorge Granda, general manager of AK Drilling, a drilling contractor that serves both major and junior companies in Peru, elaborated on this: “While new high-return investment products turned some investors away from mining, gold continues to be a safe investment, while copper is still attractive, even though it is tied to global economic growth. In Peru, the main issues are permitting and social acceptance, and



Bill Pincus,
president and CEO,
Miramont Resources

to have more projects like Quellaveco or Marcobre, the government needs to promote

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exploration; having to wait for years to obtain permits does not make sense.”

Miramont was a good example of this: when everything seemed ready to start drilling at its Cerro Hermoso project in June 2018, the Ministry of Energy and Mines decided it needed further evaluation before granting the permit to see if the project would require the ‘consulta previa’ process (prior consultation with indigenous communities). The government took six months only to decide that this was actually unnecessary.

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, as they need need to cover their administrative and public market costs no matter what they are doing, but also their market perception. 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, with good news coming from a variety of fronts in Peru’s junior segment. Regulus Resources, for instance, successfully completed its spinoff of Aldebaran Resources to have more focused exploration vehicles in Peru and Argentina; in the process, it raised C\$20 million. Zinc company Tinka Resources recently published a new 43-101 compliant resource estimate for the Ayawilca project in central Peru. Also, in January, PPX Mining obtained its permits to build the processing facilities of its Igor gold-silver project. “I think juniors are not afraid anymore, and there is greater appetite for risk. Thanks to a new school of CEOs that truly act as decision-makers, juniors are going to bring a lot of dynamism to the Peruvian market,” assured Granda of AK Drilling.

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 Merrill 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 will actually be threefold: to drill in and around the Callanquitas reserve to drive plant expansions; to do more drilling in the Portachuelos discovery; and to target the Tesoros area, on the southern side of the project. “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. Including historical data, the Igor project has had 30,000 m of drilling so far. Now, PPX plans a 17,000 m campaign, to be completed between 2019 and 2020, after the plant commissioning.

COPPER

Regulus Resources is another player that has kept a busy program. On top of the drilling campaign at the AntaKori copper project in Cajamarca, last year the company spun out its Argentinean assets into a new vehicle, Aldebaran Resources. Looking at the activities on-site, the company completed its first phase of drilling with over 20,000 m in 31 drill holes, more than doubling the drilling previously done on the AntaKori project.



Brian Maher,
president and CEO,
PPX Mining



John Black,
CEO,
Regulus Resources



Jorge Granda,
general manager,
AK Drilling

With this information, the company plans to publish a new 43-101 resource estimate before the end of Q1 2019, although CEO John Black assured this will just be an ‘interim’ resource: “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.” Indeed, in hole 26, the most northerly hole drilled to date, the company had an interval of nearly half a km

(473 m) at 1.16% Cu (1.39% Cu equivalent). Black assured that the significant precious metal content associated to the copper is one of the key advantages of AntaKori. AntaKori is located right next to the Tantahuatay gold mine, owned by Coimolache (a joint venture of Buenaventura and Southern Copper). Currently a gold oxides mine, Tantahuatay will transition into a sulphide copper-gold operation at some

point. Indeed, Regulus has a collaborative agreement with Coimolache for exploration, and also has an option in an area north of Antakori to form a joint venture with Buenaventura. Black gave more details about these partnerships: “We are in an exciting neighborhood with Buenaventura, Southern Copper and Gold Fields operating two mines immediately adjacent to us. The agreements

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NEW JUNIOR PLAYERS

Peru’s attractive geology across multiple commodities has acted as a magnet for new companies. The aforementioned Miramont Resources, for instance, was only established in 2017. Meanwhile, another new player is Latin America Resource Group (LARG), a company focused on the Jasperoide copper project in Cusco, located in between the Las Bambas and Constancia copper mines. Jasperoide’s current land package of 7,100 hectares includes the initial 1,200 hectares that LARG acquired from Hochschild, and which already had an internal resource of 50 million mt at 0.8% copper equivalent. 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



Image courtesy of Regulus Resources

“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, and are very thick. Having good drilling results there would support our transaction to go public.”

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



steps at Jasperoide: “We moved on to 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. So, we have a historic resource, recoveries are good, and the project already has an initial economic model on the resource.” 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. LARG is currently a private company, but it plans to reach the public markets, probably through a reverse takeover process (RTO).

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, and are very thick. So, we want to drill out some of those and have those results support the transaction to go public.”

Meanwhile, further to the southeast in the Puno region, Miramont Resources started drilling in January at its Cerro Hermoso polymetallic project, for an estimated total between 3,500 m and 5,000 m. President and CEO Bill Pincus explained that the whole project area is about 4-5 square km, with many different styles of mineralization: “The overall target is a diatreme-related deposit. Examples of these types of systems that have been successfully developed would be Peñasquito in Mexico, and Cerro de Pasco in Peru. We see a polymetallic type of deposit; some areas are gold rich, and others are base metal rich. If we are successful, we have the chance of defining a large deposit.”

Miramont also has a second project, Lukkacha, where the company still cannot work because it needs a special authorization from the government, as the project sits within 50 km of Peru’s national borders. “Once we obtain the supreme decree in regards to Lukkacha, we want to begin some ground investigation with a geophysical program there,” Pincus concluded.



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Engineering and Construction

The uptick in activity translates into more work across the board

Last year, the general sentiment among engineering firms was that 2018 began with a greater buzz than seen in previous years. 2019 has continued this trend, so it seems that the first quarter is no longer a quiet period for consultancy firms.

Paul Murphy, manager for South America at Mining Plus, an Australian consultancy firm, has seen a boost in market dynamics over the last couple of years. He said: “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.” SNC-Lavalin is overseeing the construction of different items at Antamina, including the tailings dam.

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, 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 framework contracts.” Anddes, a local firm created by former Vector Engineering staff, is now a large company with 300 people in Peru.

SECTOR CONSOLIDATION

Through mergers and acquisition 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.

Alberto Coya, general manager of Stantec in Peru, 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.”

Luis López Salgar, country manager of WSP, summarized the main areas of expertise absorbed by WSP 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.”

López Salgar added that the strategy now is to put all this experience under the WSP brand and promote cross-selling across the organization, looking at the mining industry as a key target. As an example, the company is already using its power transmission experience to design the transmission line for Quellaveco. “We want to offer an integrated solution for the mining operations’ whole infrastructure. 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.

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 less new environmental impact assessments (EIAs), the

“Today, more tailings 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.”



-Denys Parra,
general manager,
Anddes

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.

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,” said Almenara of SNC-Lavalin. “If your environmental management plan is not good, you will have problems during the operation.”

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 initiatives 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.

Alberto Coya of Stantec elaborated on 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.”



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Denys Parra of Anddes agreed that the industry is only making shy efforts toward dry stacking, and that in Peru handling filtered tailings becomes difficult during the rainy season. Anddes is actually focusing on consolidating its tailings 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. Last year it brought speakers from the Canadian Dam Association, and for 2019 the company plans to bring professionals from Australia’s ANCOLD.

Parra commented on how mining companies have been changing their approach towards tailings safety: “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.”

While having a clear idea of who is responsible for accidents is a good move, the industry needs to aim for safer options and prevent accidents altogether. If dry stacking is expensive, the cost of hefty fines from governments and courts is much higher. Back to Brazil, the initial Samarco settlement signed by Vale and BHP Billiton was worth 20 billion Brazilian real (BRL) (more than US\$5 billion). Now, the Brumadinho event will add to Vale’s bill, while leaving irreparable human damage and a scar on the industry’s reputation.



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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 Corocochuayco 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 Byrnescut, 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.”

Another consultancy firm looking at growth in Peru’s underground segment is Stantec, transferring its experience in this field from North America. 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.”

UNDERGROUND CONTRACTORS

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, Peru’s largest underground contractor, 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.” Carozzi added that, since the machines are often located in confined spaces, their utilization ratio is just between 25% and 50%. In line with this quest for productivity, some mining companies are



Luis López Salgar,
country manager,
WSP



Gianflavio Carozzi,
general manager,
AESA



Eduardo Cossio Chirinos,
CEO,
INCIMMET

looking to have a sole integrated contractor that can handle the whole operation. The problem is to have a company with enough shoulders 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 go for the single contractor model yet, although AESA, part of 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

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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. If one of the pieces does not fit, the whole mining cycle suffers.”

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.”

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 recognized in the narrow-vein segment for designing and producing a 1 m wide jumbo. And recently Robocon, a shotcrete specialized contractor, 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.

Besides, 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, and that helped us reduce the number of machines from 23 to 19 in that operation, which also meant 15 less people. The savings of this technology 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.

Transforming the Dinosaur

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

How fast is the mining industry adapting to the automation and digitalization era? Certainly not 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. And if you look at underground mining, in Peru the industry 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. It is very difficult for us to imagine how mining operations are going to be run in the distant future, but it is going to be completely different,” he said. In this context, the main original equipment manufacturers (OEMs) and technology



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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.

Victor Gobitz, CEO of precious metals miner Buenaventura, explained that the company has recently created the position of chief innovation officer to push and 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. This requires a substantial initial investment in digital connectivity, but after that the productivity gains are potentially impressive,” he said. Ángel Tobar, general manager for the Andean region at global equipment manufacturer Epiroc, explained that connectivity offers great opportunity not just for remote operations but also for data acquisition and mine digitalization. He gave more insights about Epiroc’s Mobilaris and Certiq systems: “Mobilaris gives you very precise positioning information of both machines and operators and, together with Certiq, allows you to gather a lot of data about the machine. This way, the industry is moving toward the next level, which is real-time mining.”

BEYOND AUTOMATION

The transformation of mining is not only based on automation and digitalization; the industry continues to assess if the current methods of extracting ore are actually the most efficient ones. In hard-rock deposits, continuous mining is shaping up as the way to go 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.

One key element in mining equipment 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, explained 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 where mines are located in remote areas, 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 in Peru for its shotcrete spraying machines, explained that the company is adapting to some key developments in the Peruvian underground mining segment: “The trend is to move

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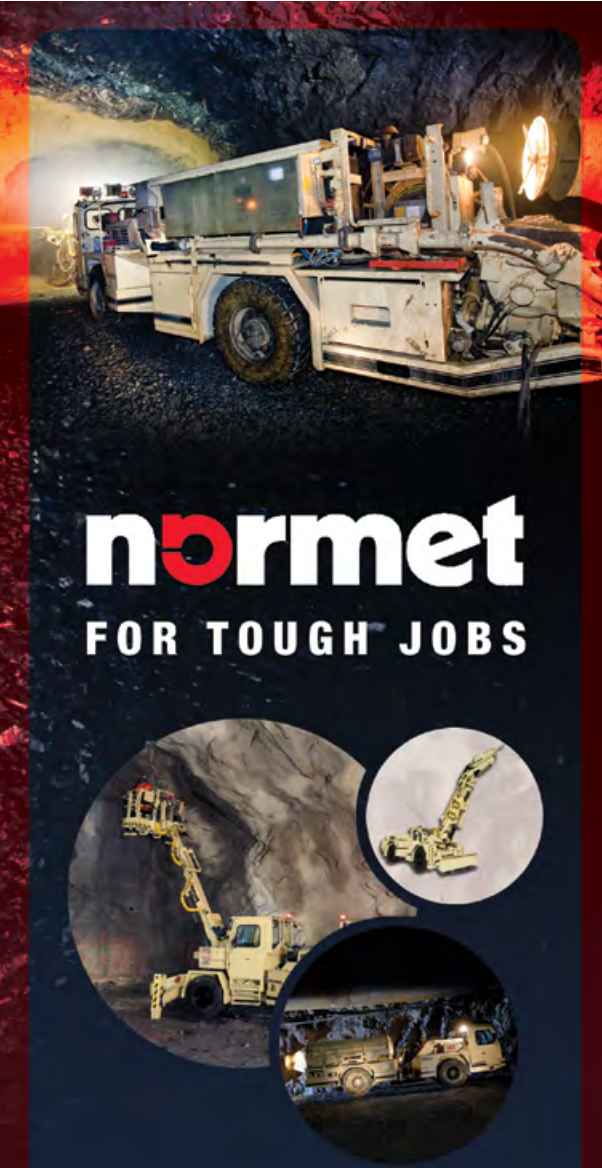


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toward mechanization. Peru has made great progress in drilling with computerized equipment, also in scaling, and now we are going to see the mechanized charging of explosives, both for ANFO and emulsion.”

Pease said that right now, explosives charging is the ‘weakest link’ of the whole mining chain, since it is predominantly done in a manual way. “If all the process is mechanized, but you charge the explosives manually, you increase the risk of having some deviation. Mechanized charging is an area where we see great opportunity, because it will allow mines to reach higher standards and be more competitive,” said Pease. Normet has around 20 models of its Charmec equipment for this task, adapting to different tunnel conditions and volumes required.

Meanwhile, recently-passed safety regulations for underground mining 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. This is the result of the overall mechanization of processes, even in small mines, that is creating the need for all sorts of equipment.

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. “The Latin American market is becoming more efficient, and it requires more competitive lead times,” Pease concluded.

ANCILLARY EQUIPMENT

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 that is used in the mining shovels.

Richard Rodríguez, general manager of Sullair del Pacífico, explained how this new model allows for continuous operation, even during maintenance: “With the ES-8 you have a primary unit and a backup unit, and that prevents the shovel from having to shut down during maintenance. Without this duality, you would have to stop the operation, uninstall the air compressing unit and install a new one.” Rodríguez said that air compressors cost a tiny 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. Last year we already sold some of these units in Peru.”

Rodríguez explained that, at a product level, the company will progressively incorporate connectivity and IoT tools thanks to Hitachi’s high levels of technology. At the Peruvian market level, service is a key component for Sullair del Pacífico, considering the company has an installed fleet of 7,000 machines country-wide. Due to the importance of the mining industry in the south, the company has recently opened a service shop in Arequipa.

PLANT EQUIPMENT

Metso, a Finnish company specializing in mineral processing equipment, also set up shop in Arequipa a few years ago. Considering how southern Peru is building up its copper production capacity, the move made total sense – indeed, today the Pacific Rim region comprising Chile and Peru is the largest revenue generator for the company worldwide.

For Fernando Samanez, VP Sales Mining Equipment for the Pacific Rim at Metso, 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, 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


“The advantages of continuous mining versus discontinuous operations are obvious. So far the technology has been used for soft rock, like coal or potash, but we are already transferring that to semi-hard or hard-rock applications.”

-Ángel Tobar,
general manager,
Epiroc





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.

On top of its strong position in comminution, Metso is also developing filters for different applications. The company already has a filter for concentrates called VPA, and now it is refining a prototype for its VPC filter for tailings: “Tailings filters require different pressure because you do not need to dewater as much, yet you require a larger filtering area. We expect to commercialize our first VPC filter in 2020,” announced Samanez.



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Mining Services

Investment in technology is driving efficiency across contracts

During the crisis, cost-cutting initiatives across mining operations became commonplace. Some of them were marketed with attractive names, like the 'AAA,' for "Antamina saves now". In reality, these moves created enormous pressure on providers to reduce costs, and in some cases these strategies were counter to overall efficiency, for example by 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 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 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 contracts allow us to renew our fleets and to invest in hands-free technology, following the industry trends. Today, the market is going 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, however 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 final client's court: "These technologies demand big 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, contractors are actually 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.

BLASTING

During the crisis, shorter contracts were also seen in the explosives market. For



Miguel Ángel Arenas,
general manager,
Geotec

Mario Matuk, general manager of Exsa, a blasting solutions company, this had negative consequences: "The issue with short contracts lies on the learning curve. We are talking of remote deposits and complex facilities, so if the timeframes are too short, you do not get to optimize the process." Today, the trend in blasting is to have at least three-year contracts.

The market continues to be very competitive, including large players such as Orica, Famesa, Enaex and Maxam. For Matuk, the key component 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%.

Matuk 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."

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What is your focus for this year's participation at PDAC?

JLB: We have a very strong Peruvian delegation, not just in terms of numbers, but also because we have government heavyweights in our activities in Toronto, and over the years the participation of foreign investors has been increasing. PDAC is like a World Cup where the different jurisdictions showcase their strengths; traditionally, countries just present their project portfolios, but our goal is to go deeper into the main issues surrounding the industry: for instance, environmental matters and bureaucracy, in order to give investors a full overview of what to expect in Peru. We have also invited the regional presidents and mayors from the mining areas; this will be important, especially now that we have new authorities, so that they can see in person how difficult it is to attract investment.

How would you evaluate the current status of Peru's mining industry, and the potential of its copper portfolio?

PF: We see a period of optimism with three flagship projects under construction: Quellaveco, Mina Justa and the Toromocho expansion. At the SNMPE we foresee mining investment to reach US\$6 billion this year, which is 15% more than in 2018. The country's project portfolio includes 48 projects worth US\$60 billion; of these, half of them are in copper. If these copper projects were put into production over the next decade, we could easily double our current copper production to 5 million tonnes per year (mt/y), and that would increase tax revenues by US\$2.5 billion annually. 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. Additionally, current copper fundamentals are very solid, thanks to the transition towards a carbon-neutral world: an electric

vehicle uses four times more copper than a combustion engine vehicle, and a 3-megawatt wind mill uses four mt of copper.

How can the industry tackle social issues, and what is the situation with the new regional authorities?

JLB: Some regional presidents are not categorically anti-mining, but they do not understand the problems of some particular projects. In any case, Peru cannot afford to have a 20% poverty rate when the country has such rich geological resources. Our GDP needs to grow by at least 7% or 8% annually to tackle these issues and, for that, the country needs mining.

PF: Social conflicts are the main obstacle to mining investment nowadays. The perception of people in the mining regions is that the wealth created by the industry is not fairly distributed. Therefore, the mining canon needs to be reworked. In parallel to this, there is regulation that does not add value at all, so we need to simplify procedures. In the end, the authorities will work to promote mining investment and close economic gaps. Over the last decade, the industry has transferred nearly 40 billion soles (PEN) to the regions, and the industry accounts for nearly 20% of all taxes collected.

What technology transfer are we seeing in mining between Peru and Canada?

PF: Toronto is today an innovation hub in deep learning and artificial intelligence, competing with Silicon Valley. What we are going to see is a digital transformation of the industry, and Canadian technology will play a key role.

JLB: Some of the Chamber's members are providers that have cutting-edge technology in terms of robotics and automation, and we are constantly exchanging knowledge with Canada. PDAC will also be a good opportunity for networking in this respect.



GLOBAL BUSINESS REPORTS

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