

Peru Mining 2018

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Putting Investment in front of Political Drama

The new government must prove that new mining projects can be developed under its watch



Photo courtesy of Volvo

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

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

Interestingly enough, in parallel to all this the mining industry continued its recovery path, with solid commodity prices helping companies across the board reduce their debts and move their feasibility-stage projects towards a construction decision. Indeed, after three consecutive years of decline, total mining in-

vestment in Peru increased by 15.7% and reached US\$4.92 billion in 2017. For 2018, the government expects an additional 20% growth.

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

Luis Marchese, Anglo American's country manager, is the person who worked hand in hand with Martín Vizcarra during that process. Speaking as president of the SNMPE, the mining industry's main association, Marchese gave his impressions about Vizcarra's new cabinet: "This government is more pro-decentralization than the previous one. Both the new president and the new prime minister are former regional governors, which should help give impulse to the mining activity, considering that mining is a decentralized industry."

Marchese further elaborated on this: "I have always believed that the main obstacle for the development of new mining projects was not the Ministry of Energy and Mines but the limited involvement of regional and local authorities. I have the feeling that this

new government will be more familiarized with that dynamic: regional governments have to be much more proactive to promote mining activity.”

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

NEW YEAR, NEW PROJECTS?

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

Even though there is not an official construction decision about Quellaveco yet, Anglo American already has around 3,000 people in the area doing substantial early works, such as the diversion of the Asana river. Meanwhile, Minsur made a significant step towards the financing of its US\$1.6 billion Mina Justa copper project by selling 40% of the asset to Chile’s Inversiones Aljar (part of the Angelini Group) for US\$200 million. Finally Chinalco, who had a very challenging ramp-up at Toromocho over the last years, should finally proceed with the copper mine’s expansion.

That is the expectation, but the triggers are yet to be pulled. As an example, Anthony Hawkshaw, president and CEO of Bear Creek Mining, remained cautious regarding Corani’s potential construction schedule: “There is only one chance to build a project correctly. It is wiser to



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Luis Marchese, president, SNMPE

spend additional time and investment now on engineering than to rush ahead. We are being deliberate, thorough, and patient to minimize potential risks.” Corani, one of the largest undeveloped silver deposits in the world, has a significant zinc content. With the zinc price reaching an 11-year high, one would assume there would be pressure to act. However, the project requires a capital expenditure of US\$585 million, a large amount for a junior company, and Hawkshaw and Bear Creek’s shareholders have seen a lot of failures over the years arise from rushing into construction. “When I

was a lecturer, I used to tell my students: think first, write later. You can process much more when you are thinking rather than when acting, and I believe this is the right approach for us,” he concluded. Involving the right talent will be key for mining companies to develop their projects successfully and avoid the mistakes of the past. No-one expects a mining boom such as the last super-cycle, yet there is already some movement of executives, in both the C-level and middle management. Alberto Calle, principal at Korn Ferry, a human resources specialist, said: “We have started to see more

movement of professionals in the mining sector, a trend that has been more noticeable in Chile. Due to a lack of investment in the industry for many years there is a gap –you often find professionals that are either quite old or very young. This certainly makes people with experience more valuable, and has also prompted organizations to look for professionals beyond Peru’s borders.”

UPCOMING ELECTIONS: THE SOCIAL ASPECT

Peru will be conducting regional and municipal elections on October 7th, and once again mining will be on the agenda. While the changing of authorities may produce added hurdles in terms of bureaucracy and relationships, the sector has been generally positive on the potential outcomes of the ballot. Indeed, many believe that there has been a change in how communities and politicians perceive the mining industry, especially in regions where anti-mining sentiment has been high. Phil Dalke, managing director of Tahoe Peru, said: “Our relationship



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Anthony Hawkshaw,
president and CEO, Bear Creek

with our communities can change depending on the different dynamics, however we strive to make our communities partners in our sustainability projects. We sense that many of our communities want more mining activity."

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

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

GDP growth in 2017 was only 2.5%, an insufficient figure for a country on its way to further development. Mining will continue to be the key driver of Peru's economy, and taking advantage of the high metal prices will be key to building momentum and unlocking a new wave of mining investment. As has been the case in the last two decades, mining projects may prove to be a significant catalyst for Peru to climb the ladder of economic development. ■

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Precious Metals: The Challenge of Keeping Volumes Up

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

Peru maintains a key position in precious metals mining and development. In 2017, it remained the world's sixth largest gold producer (and the largest in Latin America), while it was also the world's second largest silver producer, only after Mexico. Peru's gold production remained relatively stable and only recorded a 1.2% decrease year-on-year. Total output reached 4.86 million troy ounces, with Yanacocha

contributing 535,700 oz. This still places the operation located in Cajamarca as the country's largest gold mine despite its continuous decline. The guidance for this year is around the half a million-ounce mark and, with the Quecher Main project, its life should be extended until 2027. Quecher Main, a US\$250 million to US\$300 million venture, will add new output from oxides starting next year, with

expected production of 200,000 oz/y between 2020 and 2025.

Yanacocha is a joint venture between Newmont, who operates the mine, and Buenaventura. On top of its 43.65% share of production at Yanacocha (233,400 oz), Buenaventura also had an attributable production of 383,200 ounces from the gold mines it operates, namely Tambomayo, Orcopampa, La Zanja and Tantauatay.

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Víctor Gobitz, CEO of Buenaventura, anticipated higher production figures this year from Tambomayo, which reached commercial production last year, and Coimolache, where the company is processing the oxide stockpiles acquired from the neighboring Cerro Corona operation. He also provided more details about the three-year debottlenecking project at the company's main underground mines, including historic assets that have been in operation for decades: "In Orcopampa, the deeper side of the mine offers high grade but we have not developed a shaft, so with the ramp we are extracting less volumes at higher costs, including additional ventilation costs. In other mines, we are implementing better ventilation or dewatering solutions to extend the mine cycles. We also want to move our backfill around as slurry, with pumps, rather than having to use trucks and scoops."

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

Beyond Newmont and Buenaventura, the other large gold producers include Barrick, that recorded 508,700 ounces between Lagunas Norte and Pierina; Tahoe Resources, that produced 275,000 oz at its La Arena and Shahuindo mines; and Gold Fields, that had production of 166,000 oz of gold at Cerro Corona, a medium-sized mine in Cajamarca that also provides important copper volumes (gold equivalent production is 314,000 oz).

STRETCHING MINE-LIFE

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

According to the company's executive director in Peru, Manuel Fumagalli, a transi-

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tional phase for mine-life extension would involve a mill and carbon-in-leach recovery circuit to process the carbonaceous oxide material in the stockpiles, for a total output of 600,000 oz between 2021 and 2026. Then, the PMR project would require a flotation and autoclave process for the sulfides and, if approved, would produce 2.2 million ounces starting in 2026.

Fumagalli emphasized the importance of the company's global digitalization programs, such as the short-term interval control initiative to manage all the key performance indicators. "In Lagunas Norte, for instance, this led to significant benefits from improvements in our activated carbon in column circuit," he said. Meanwhile, Gold Fields has also pushed to add mine-life at its Cerro Corona mine, expected to be running until 2030 after a seven-year extension. Luis Rivera, executive vice-president of Gold Fields for the Americas, explained: "Mining is like a credit card, it has an expiration date. At the beginning of 2017, Cerro Corona was scheduled to shut down in 2023. That meant that, from 2018, we would have

"We are extending mine cycles through better ventilation, dewatering solutions, and moving our backfill around as slurry. Allocating our money to improve efficiency in our running operations presents less technical risk and a quicker return on investment than developing a greenfield project."



Víctor Gobitz, CEO, Buenaventura

had to start closure activities, reducing our footprint and our workforce. We made it an urgency to extend the mine life."

Considering the space limitations Cerro Corona faces in Cajamarca, achieving this took its share of engineering and creativity. Alberto Cárdenas, vice-president of operations at Gold Fields, commented on that: "The beauty of the solution is that we are not extending the superficial footprint. We are challenging the density of the tailings to accommodate more volume within the same facility. Also, at the end of the

day the pit is also an asset, so we are looking at placing some tailings within the pit after the operation."

Also in Cajamarca, Tahoe Resources continues to ramp up its operation at Shahuindo, where it is commissioning a crushing and agglomeration (C&A) plant to improve recoveries from the fines of the ore body (production of 79,000 ounces in 2017 came from run-of-mine ore). Once the plant is commissioned, Tahoe will embark on the expansion of Shahuindo from 12,000 mt/d to 36,000 mt/d. "Our other

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“Mining is like a credit card, it has an expiration date. Cerro Corona was scheduled to shut down in 2023, and we made it an urgency to extend the mine life.”

Luis Rivera,
executive VP
Americas,
Gold Fields



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

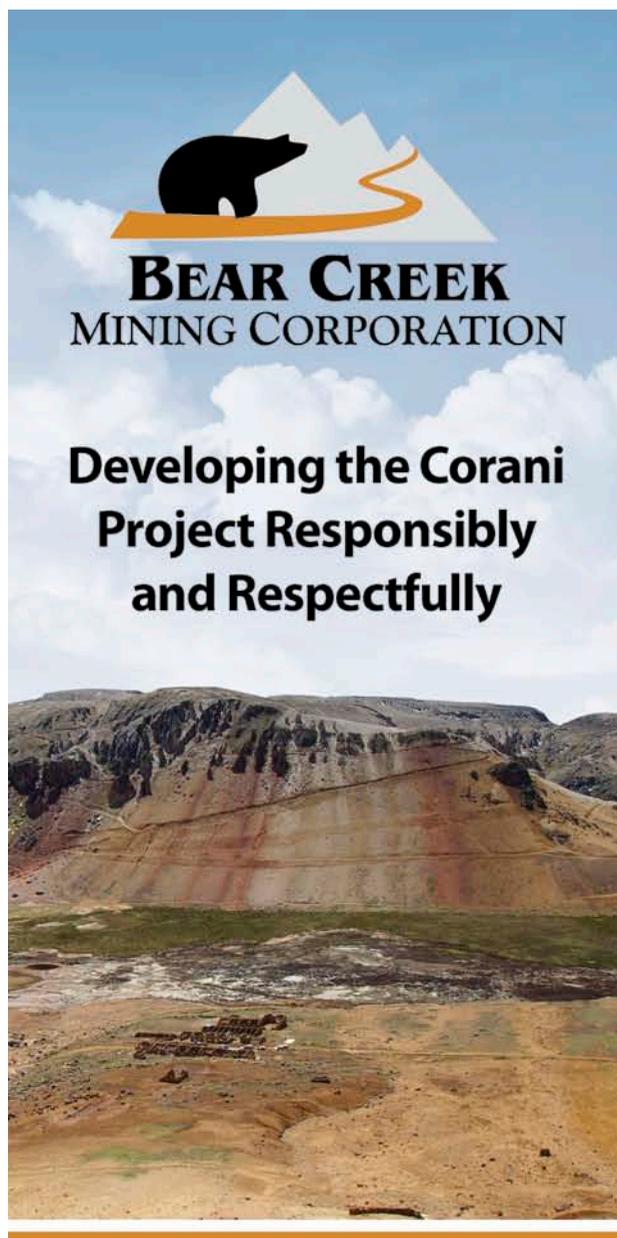
Peruvian companies account for significant gold production as well. These include Poderosa (254,000 oz/y), Horizonte (253,000 oz/y), and Hochschild Mining, traditionally a primary silver producer, that has been increasingly leaning towards gold production with the impulse of the Inmaculada mine. Hochschild produced 203,600 oz of gold in Peru last year, and 165,000 of those ounces came from this flagship asset.

With respect to Poderosa, the company is currently expanding its processing capacity, from 1,400 mt/d to 1,600 mt/d this year, in between the Marañón and Santa María plants. One of the main items of the expansion in terms of the *capex* is the tailings dams, explained Marcelo Santillana, general manager of Poderosa: "With the investments in the Liviás and Hualanga facilities, the tailings dams will now have a life of 22 years. Moreover, we filter the tailings, so we do not deal with pulp anymore."

Poderosa expects to produce 270,000 ounces of gold this year and continues to look at formulas to optimize production and extend mine-life. Santillana continued: "We are developing a project to separate the sulfides from the silicates. This will improve the secondary recovery of the gold that is in the sulfides, and will add to our production from 2019 onwards. We are also looking at an additional project to recover gold from the tailings," he said.

Poderosa sits in La Libertad, one of the most prospective regions for gold exploration and development, where there is a sizeable amount of artisanal mining as well. Indeed, Poderosa itself has nearly 300 contracts with artisanal miners to buy ore from them, in an agreement that provides employment to nearly 3,000 people. Elsewhere in La Libertad, Corporación del Centro (CDC Gold) is advancing the El Toro project, a gold operation that could not be developed in previous years because the area was invaded by illegal miners. With a team of former Barrick and Newmont professionals, CDC Gold managed to eradicate most of the illegal mining in the area and integrated many of those miners into its workforce, consisting of 1,300 people today.

El Toro is an epithermal gold deposit hosting around 1 million ounces. The open pit operation with heap leaching and a car-



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bon-in-column plant will have an estimated initial production of 100,000 oz/y. Construction is already under way, and mining operations should start before the end of the year.

Jaime Polar, general manager of CDC Gold, gave more details: "Our stripping ratio is quite good, just 2:1 according to our mine plan, and we also have favorable hydrogeological studies, that indicate that we will not have to dewater the pit. In its first phase, the capital investment to put El Toro into production amounts to around US\$150 million." Once in operation, the company will focus on brownfield exploration with the goal to double the size of the deposit to 2 million ounces.

SILVER

Silver production in Peru also decreased by 1.6%, totaling 138.4 million ounces. Buenaventura is the country's largest silver producer with 23.3 million ounces in 2017, a figure that does not include the additional 4 million ounces coming from El Brocal, another company that it controls. The other main silver producers in the country are Antamina, with 20.8 million oz/y; Volcan, with 15.9 million oz/y; and Hochschild Mining, with 15.9 million oz/y. The latter company had production costs of around \$12.5/oz silver equivalent last year, and those should increase slightly in 2018, to between \$13/oz and \$13.4/oz according to the corporate guidance. Part of this cost increase is the \$30-million investment in the Pablo development at the Pallancata mine in Peru. "In 2017, Pallancata was working at 1,400 metric tons per day (mt/d). Through incremental expansions, we will reach 2,800 mt/d by Q3 2018, and production will stabilize at that rate," explained Ignacio Bustamante, CEO of Hochschild Mining.

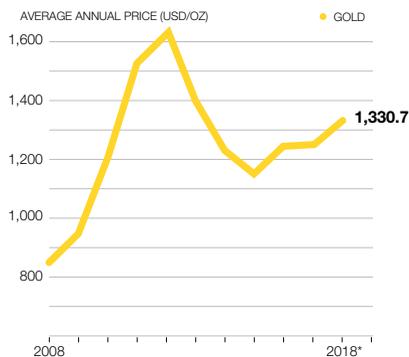
"2017 was a great year for Pallancata as it was very profitable, with the development of the higher-grade Pablo Pisos areas. Although the grade will now fall with the development of the main body, the tonnage will increase and so will production, from 7.5 million oz/y to approximately 9.5 million oz/y," continued Bustamante, who added that the company's main focus is on developing its brownfield projects, to fill up the spare capacity currently available at the Arcata, Pallancata and Ares plants.

Peru's rich silver and polymetallic ore deposits are also attracting new players to the industry, such as Mining Sense, a company that recently acquired Recuperada, one of Buenaventura's former historic mines. Mining Sense is putting the asset back into production this year, initially as a toll processing plant for third party ores. José María García, CEO of Mining Sense, explained the rationale behind this strategy: "We are surrounded by a number of operations, including many small mines that produce less than 100 mt/d. A number of these companies send their ore to processing plants on the coast at very high costs. With the restart of Recuperada, we will allow these miners to dramatically lower their costs, while we will be able to blend different concentrates, improving our marketing position."

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

GOLD AND SILVER PRICE EVOLUTION

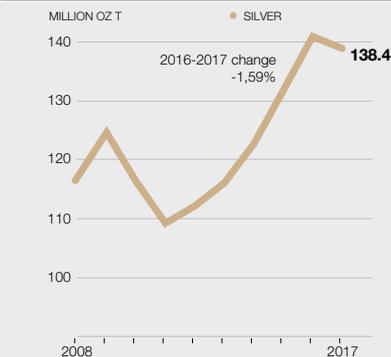
Sources: KITCO / GBR



*Up until April 30th

PERU, A DIVERSIFIED METALS PRODUCER

Sources: Ministry Of Energy And Mines / GBR



ZINC PRICE (MONTHLY AVERAGE)

Average official LME price, Cash Buyer

Sources: LME / GBR

Year	Month	\$/MT	\$/LB
2017	August	2,981	1.35
	September	3,119	1.41
	October	3,273	1.48
	November	3,235	1.47
	December	3,192	1.45
2018	January	3,446	1.56
	February	3,539	1.61
	March	3,280	1.49
	April	3,190	1.45

COPPER PRICE (MONTHLY AVERAGE)

Average official LME price, Cash Buyer

Sources: LME / GBR

Year	Month	\$/MT	\$/LB
2017	August	6,477	2.94
	September	6,582	2.99
	October	6,796	3.08
	November	6,825	3.10
	December	6,801	3.08
2018	January	7,079	3.21
	February	7,001	3.18
	March	6,795	3.08
	April	6,838	3.10



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Manuel Fumagalli

President of the Organizing Committee, 13th International Gold and Silver Symposium



“Digitalization is a transformational endeavor that will be at the core of mining operations”

What are the main themes of the 2018 Gold and Silver Symposium?

This year, on top of the usual market projections and pricing forecasts, the event is putting special emphasis on innovation. Due to the crisis, mining companies had to be creative and increase efficiency and competitiveness, and in this respect new digital technologies, the use of big data and artificial intelligence are bringing drastic changes to the way the industry operates. Our keynote speaker, Anders Sörman-Nilsson, will provide a comprehensive overview on how the world and industries are going from analog to digital, and how that is prompting the need for more changes within the organizations. Before, IT was seen just as an ancillary or support area, but moving forward digitalization, which is a transformational endeavor, will be at the core of operations.

How can organizations adapt to this change?

Digitalization means disruptive change, and for it to provide good results, you need strong leadership and a new culture across all levels of the organization, not just within the IT department. People are resistant to change, but with a strong tone from the top, a clear definition of the company's vision and objectives, and a good flow of information and purpose to all the employees, positive change will be achieved. Digitalization is here to stay, so organizations just need to adapt or risk disappearing. Overall, this is going to create a much safer, more productive and more transparent industry.

The world continues to be an unstable place. What are the fundamentals of precious metals as a safe investment?

Our world presents many challenges and geopolitical events that generate instability and fears. In this context, gold and silver are always seen as a safe haven for investors. Gold is sensitive to events such as the Federal Reserve increasing interest rates, inflation risk or a potential U.S.-China trade war. Besides, with the risk of new global mine gold supply decreasing, the dynamics of the demand and the supply could change as well. Finally, while there are new assets out there that are competing for investment, such as the crypto-currencies, gold should always remain the leading safe-haven investment.

How attractive is Peru for mining exploration and development in precious metals?

Peru has an enormous geological potential, as shown by the fact that it is the first gold producer in Latin America and sixth in the world, and the second silver producer, both in Latin America and worldwide. In the last Fraser Institute survey, Peru ranked 19th for mining attractiveness and 14th for geological potential. According to the Ministry of Energy of Mines, Peru has a US\$51 billion project portfolio, and 15% of that is in gold and silver. Meanwhile, with improved mineral prices, the expenditures in exploration are increasing significantly in the country.

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Copper: Closing the Gap with Chile

Peru strengthened its copper output in 2017, reaching 2.45 million tonnes

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

Suresh Vadnagra, president of Minera Las Bambas, commented on the mine's performance on its first year of full commercial production: "Our C1 cost of \$0.99/lb positions us as one of the lowest cost producers. In 2017, we took some fairly aggressive steps to establish efficiency as the baseline of Las Bambas, which is something that does not normally happen in the first year of production."

Vadnagra anticipated that the copper operation, located in Apurimac, will yield between 410,000 and 420,000 mt of copper in 2018, at a C1 cost between \$1/lb and \$1.10/lb. "Our focus is very much on building on the success of 2017 into the future years," he continued. "Las Bambas has enormous potential for brownfield growth –this includes the development of further satellite pits and resource expansion. The Las Bambas tenement has 35,500 hectares, and so far we have explored less than 10% of it."

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

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

El Brocal operation narrowly beat Nexa Resources' Cerro Lindo as the country's largest underground copper producer (both are in the 45,000 mt/y range). Meanwhile Condestable, operated by Southern Peaks Mining, yielded 22,000 mt of copper in 2017.

Víctor Gobitz, CEO of Buenaventura, was enthusiastic about El Brocal's future potential, as the company no longer has commercial restrictions for arsenical copper: "There is an opportunity to go from room and pillar to a different mining method that also extracts the ore from those pillars. If we are successful doing that, the Marcapunta mine could grow up to 20,000 mt/d," he affirmed. Marcapunta is already expanding from 8,000 mt/d to 13,000 mt/d by the end of this year.

Southern Peaks Mining has also introduced new mining methods as a way to improve both productivity and efficiency, with a focus on mechanization at Condestable, and is increasing its daily throughput from 7,000 mt/d to between

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9,500 mt/d and 10,000 mt/d. Adolfo Vera, Southern Peaks Mining's CEO, said: "We started treating the previously known mantos as ore bodies and, for that, we needed to know the geometry in each particular ore block prior to mining. We then designed the drilling and blasting scope with the knowledge produced from the geology infill findings. That has given us incredible results as we have introduced long hole mining into 80% of our operation, and dilution has decreased by 75%." The C1 cost at Condestable is \$1.55/lb and, with the expansion, it can be reduced to \$1.25/lb, according to Vera. Beyond productivity, one of Southern Peaks' main objectives last year was to double the reserve base and prepare for the company's future IPO. "The exploration is rendering great results as well, and we expect to be mining at Condestable for more than 20 years," he concluded.

Looking at the general picture, Peru's copper production continued to close the gap with Chile. The neighboring country saw its red metal output decrease slightly to

"One of the first steps was to imagine how Las Bambas would operate in five or ten years' time. With this in mind, we developed our digital road map, that includes automation, mobilization, real time monitoring and integrated planning platforms, as well as data analytics and artificial intelligence."

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



5.5 million mt/y. Record monthly production in Chile in December 2017 was not enough to compensate the effects of the strikes at Escondida earlier last year. Following Chile and Peru, China is the third largest copper producer globally with output of approximately 1.9 million mt/y. The Peruvian government has set a goal of increasing copper production by 30% by 2021 to further cement Peru's position as the second largest producer of copper globally.

OTHER BASE METALS

With respect to zinc, Antamina regained top spot in production with a 69% increase in output, representing 442,500 mt/y of zinc. The spectacular change is probably explained by the erratic nature of the geology in skarn deposits, as well as a conscious decision by the company to boost zinc output and take advantage of the current high prices. Antamina's exceptional performance helped Peru's overall zinc production increase by more than 10%, to a total of 1.47 million mt/y. Antamina is 33.75%-owned by Glencore, that also recently took over a controlling stake in Volcan, Peru's second largest zinc producer with around 288,600 mt produced last year. Finally, Nexa Resources of Brazil (formerly Milpo-Votorantim Metais) produced 229,600 mt/y, the majority of which came from Cerro Lindo, Peru's largest underground operation.

In other base metals, Peru's lead production decreased by 2.4% to 306,800 mt, and tin production also decreased by 5.3% (total output was 17,800 mt/y), while production of molybdenum increased to 28,100 mt/y. According to the United States Geological Survey (USGS), Peru ranks as the world's second largest zinc producer, the fourth largest lead producer and the fourth largest molybdenum producer globally.

Finally, iron ore production saw a 15% increase to 8.8 million mt, driven mainly by Shougang's ongoing expansion at Marcona, while a new player, Shouxin, produced 138,000 mt of iron ore through the reprocessing of Shougang's tailings, a process that also yielded some copper. ■



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Exploration Gains Momentum

Juniors are back to life and Peru offers enormous potential for them

Following the recovery of metal prices in 2017, financing for junior exploration companies has increased and with that, has exploration in general. In Peru, one of the Ministry's key objectives for 2018 is to promote new investment in exploration and increase Peru's share of the global exploration budget from 6% to 8% by 2021. A key observation from the number of junior exploration companies in Peru is the vast geographical scope they are active in. Spanning all corners, from the tip of Peru near Lake Titicaca, to near Huaraz in the Andean mountains, and the Secura desert near the Ecuadorian border, exploration companies are seizing the opportunity to explore Peru's untapped mineral richness.

COPPER

As Peru continues to cement itself as the second largest producer of copper in the world, a number of exploration projects gather pace across the country. Regulus Resources continues to focus on its AntaKori copper project in Cajamarca, northern Peru, located immediately next to the Tantahuatay gold-silver mine owned by Coimolache, a joint venture of Southern Copper and Buenaventura. Coimolache and Regulus have actually signed an agreement to carry out collaborative exploration in the area, which will certainly benefit the advancement of AntaKori.

AntaKori has a 43-101 resource of 295 million mt at 0.48% copper, 0.36 g/mt of gold and a little more than 10 oz/mt of silver. Regulus' campaign for 2018 will be approximately 18,000 meters of drilling, and the company has already released the results of twelve holes. John Black, CEO of Regulus, said: "Drilling continues to go well at AntaKori with three drill rigs turning and plans to increase to five rigs shortly. Much of our initial drilling has focused on the southern margin of the previously known mineralization and re-

sults to date have significantly extended mineralization in this direction."

Regulus wants to use the current campaign to update the resource estimate, however John Black warned that it will take more time than that to realize AntaKori's full potential: "AntaKori is a very large project and we must be patient to fully capture the opportunity. Although it is difficult to predict what will happen with the price of gold, we do know that copper will be in shortage for the foreseeable future and demand will keep increasing. A benefit of higher metal prices is that more capital is available and this has allowed us to move exploration along more quickly." Meanwhile, in the south of the country, Kaizen Discovery has continued to focus

on its Pinaya project, located in between Arequipa and Puno. Pinaya, previously explored by AM Gold and Rokmaster Resources, sits in the same belt as Glencore's Tintaya deposit and presents typical skarn and porphyry copper-gold mineralization. After some delays created by the Peruvian government's *consulta previa* process (prior consultation with the local communities), Kaizen's drill program this year will have two primary components, according to Kaizen's president and CEO, Tom Peregoodoff: to extend the resource laterally and to explore the potential of some deeper areas. For this, the company will use Typhoon, a proprietary technology of HPX, Kaizen's major shareholder. "Typhoon enables the user to penetrate

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much deeper into the ground. This is especially important in areas where you have resistive cover. In the case of Pinaya, a primary focus of application of Typhoon is to identify and understand any significant depth potential", said Peregoodoff.

The company is also planning to drill one new target called Pedro 2000, which was identified through both existing geophysics and some ground mapping. The program has a total budget of US\$5 million, jointly funded by Kaizen's partners, Itochu of Japan, who will be earning a 20% participation in the project. "We expect this drill campaign will lead both to a second phase of drilling and to an increase in the resource," said Peregoodoff.

Peru's dynamic junior sector and its positioning as the best upcoming destination for copper exploration has helped attract other companies in this space. Newly-arrived Chakana Copper, a company that started trading on the TSX-V end of January, is focusing on the Soledad project located in Ancash. Interestingly enough,

Chakana is not targeting yet another large open-pit deposit at Soledad, but is focusing on defining the potential of its high-grade pipes instead. In the words of David Kelley, president and CEO of Chakana Copper: "The strategy of the previous operators was to find a porphyry deposit that is assumed to be related to the tourmaline breccia pipes. Our view is different. We think these high-grade breccia pipes can offer significant economic value because they are numerous, high-grade, vertically extensive from surface, and are relatively easy to explore."

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

Meanwhile, privately-owned Pembroke Copper continues advancing its Peco copper project in southern Peru, with a current resource of 644 million mt at 0.334% Cu, using a 0.25% Cu cut-off grade. Pembroke owns 51% of the project and can get to 80% ownership by completing a feasibility study and making a cash payment. The company is currently focusing on the engineering studies at a preliminary economic assessment level.

"We hired several engineering companies to complete a power line study, a road study for access to the coast, a water well study that has provided positive results for a pumping station from the gravels, and a tailings and waste dump study. What is remaining is the pit scheduling, which will be done over the next months," explained Brian Booth, president and CEO of Pembroke Copper.

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



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ZINC

In the zinc space, Tinka Resources updated its NI 43-101 resource estimate for Ayawilca, its flagship project in the department of Pasco, central Peru, which provided a 130% increase in the zinc resource. The new resource consists of 42.7 million mt with 5.6 billion pounds of zinc content (2.5 million mt Zn) as well as some indium, silver and lead. In 2018, Tinka is set to complete a 15,000-meter drilling campaign and will target new areas, including Zone 3 and Chaucha, as well as an extension of Central, South and West Ayawilca. Graham Carman, president and CEO at Tinka Resources, said: "This drilling campaign will aim to add more high-grade resources to our portfolio and further improve the economics of the project. We will have a resource upgrade by June or July. In parallel, a detailed metallurgical study will occur in Q2 2018 and then we will complete our preliminary economic assessment (PEA) over the second half of the year."

Ayawilca also hosts a tin resource, which increased in the latest 43-101 report of November 2017 for a total of 10.5 million mt containing 145 million lbs Sn. "The tin lies deeper than the zinc so it will probably not be mined from the start, yet we would like to include the tin in our upcoming

PEA as its realization is very high in terms of value. We will need to do more metallurgy and see what we can incorporate this year," Carman said.

PRECIOUS METALS

After winning its arbitration process with the Peruvian government regarding the Santa Ana project, Bear Creek Mining has continued advancing at Corani, a very large silver deposit with significant base metal content. Potentially moving into construction over the next year, and with expected production of 12 million ounces of silver annually during the first six years of operation, Corani is one of those 'company makers' that do not come in production very often in the industry.

Of course, such a large project brings significant risk associated to it. Through recent engineering, the company has reduced the estimated *capex* of the project to a US\$585-million figure, which is still high for a junior company. Anthony Hawkshaw, president and CEO of Bear Creek, said: "There are areas to save money and initial engineering observations have identified possible *capex* reductions." The company expects to receive its construction permit and complete the prior consultation process over the second quarter of 2018.



Exploration team at AntaKori. Photo courtesy of Regulus Resources



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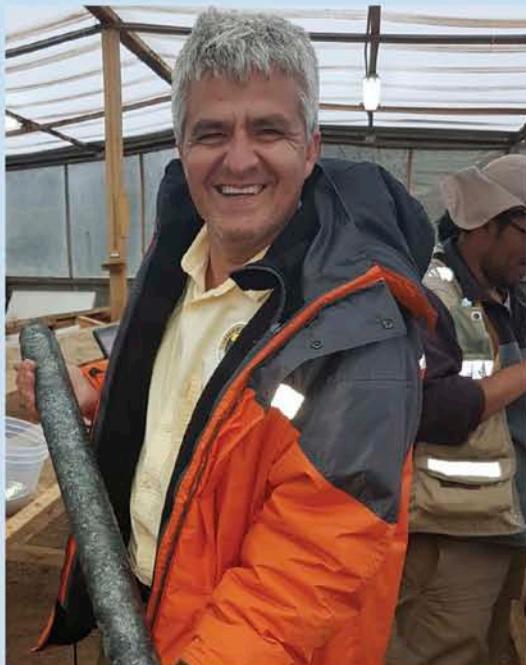
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(0.63% Tin, 0.23% Copper, 12 g/t Silver)
(\$55/t NSR cut-off value)

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



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In terms of gold exploration, there are no large junior-held projects in the pipeline, and most of the exploration activity is related to early stage projects or small mining operations by juniors that decided to move into production. Lupaka Gold, for instance, has been focusing its efforts on Invicta, a gold-copper polymetallic underground project. The company's plan is to start mine development, use a contract miner and then send the ore to a toll milling facility for processing, generating cash flow for investors. Commercial production is expected in the third quarter of 2018. Will Ansley, CEO of Lupaka Gold, gave more details about the company's plans: "We intend to operate at an initial 350 tonnes per day (mt/d). We have an initial mine plan which outlines a six-year mine life. By 2019, we will have another updated resource with an expanded concept of between 500 and 1,000 mt/d. Investing in our own plant on-site would allow us to double or triple production."

In the Ancash region, Eloro Resources completed an initial drilling campaign in 2017 at the La Victoria gold-silver project. The company is set to start its second phase of drilling, consisting of 4,500 meters. Tom Larsen, chairman and CEO of Eloro Resources, said: "At Phase I we defined a significant low-sulfidation epithermal system at the Rufina sector of La Victoria. Phase II will focus on newly discovered gold-bearing structures and how these are related in the different sectors."

When first visiting La Victoria, the Eloro team were surprised by the fact that no modern exploration had been done in the area, even though there was intense informal mining activity. A similar situation applies to another known gold region, the Puno orogenic gold belt in south-eastern Peru, where Palamina has staked a significant land package, with an initial focus in the Coasa and Gaban projects. "There is a modern day gold rush underway in south-eastern Peru by informal miners that everybody is aware of, yet little to no modern day systematic exploration is under way," affirmed Andrew Thomson, president and CEO of Palamina. "No one truly knows how much gold is being produced as large quantities cross the border and are sold to Bolivia."

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

MORE MONEY FOR DRILLING

Elsewhere in Peru, another two companies are becoming active in early exploration work thanks to the improving financing conditions for juniors –these are Miramont Resources and Pucara Resources. Coincidentally, in the past their respective CEOs worked together at Esperanza Resources, a company that Alamos Gold acquired in 2013. As a result of that transaction, Steve Zuker, former VP exploration at Esperanza, kept the grassroots properties and team in Peru and started Pucara Resources, while Bill Pincus,

Esperanza's former CEO, is leading Miramont's activities since the company was formed last year.

For Pucara, the timing for building a grassroots exploration company was not ideal, and the company had to rely partly on the prospect generator model, acquiring joint venture partners to fund exploration and survive. Today, the company counts Nexa Resources and Iamgold as partners, while it has recently closed significant financing with the support of Resource Capital Fund and Sandstorm, that should allow Pucara to engage in substantial drilling campaigns. The team has set aside around C\$3 million for its Lourdes and Pacaska gold projects this year. "During the downturn there was a lot of ground available and very few companies were picking up exploration opportunities", relates Steve Zuker, CEO of Pucara Resources. "Today, we control more than 300 square km, mostly in central and southern Peru, in Ayacucho and Cusco. We are one of the few juniors doing grassroots exploration." Pucara is focused on high-sulfidation, bulk-minable gold projects, so it is open for joint ventures on its base metals projects. Zuker is happy to see that the market is picking up: "We are seeing interest from mid-tier and major companies that are becoming more aggressive –this is new in the market. The BHPs and Rio Tintos are still in Peru but they definitely prefer projects that are more advanced."

Finally, Miramont Resources has two main projects of focus: Cerro Hermoso, a gold,

copper and poly-metallic breccia type prospect in Puno, where the company is undertaking an initial 5,000-meter drill program this year; and Lukkacha, a porphyry copper project situated in Tacna, 55 km from Southern's Toquepala mine. Being a foreign company, for the latter project Miramont requires a special approval from the central government due to the fact that Lukkacha sits within 50 km of the Chilean border.

Bill Pincus, president and CEO of Miramont, gave his impressions about the current state of the exploration market: "In the last decade, a lot of larger companies overpaid for projects and the cycle went down, which in turn caused companies to become very conservative. The effects of this can still be seen, certainly in the copper space there is a dearth of good exploration and new development projects for the large producers. The known deposits are already being mined and, in some cases, running out of reserves. I believe there will be a scramble for more gold projects as well."

URANIUM AND LITHIUM

2017 was a transformational year for Plateau Uranium, now rebranded as Plateau Energy Metals. While exploring in one of its areas in the Macusani plateau, the company made the Falchani discovery, containing uranium but also high lithium grades of 3,500 parts per million (ppm). "The deposit is at least 100 meters thick and two square kilometers in area. We are quite confident that this will be among the top lithium

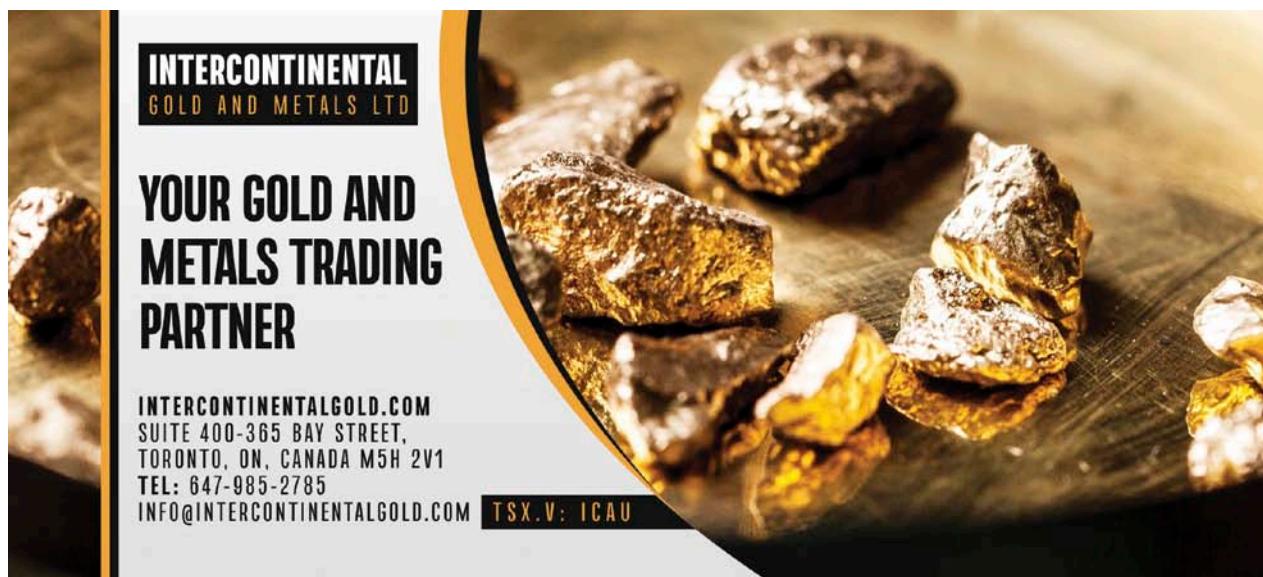
resources in the world. It is a totally new style of rock: you can process it easily and it is within 200 meters of the surface, so it is open-pittable," declared Ted O'Connor, CEO of Plateau Energy Metals.

The Falchani discovery adds to the sizeable resource the company had already defined in the area of 124 million pounds of uranium and 176,000 mt of equivalent lithium oxide. "As we move west towards the Falchani area, the focus is increasingly on the lithium," explained Laurence Stefan, president and COO of Plateau Energy Metals. "Having said this, the uranium at Falchani is double the grade of our uranium to the east, so we will end up as well with a significantly expanded uranium resource on surface."

Now, the company needs to define the size of its lithium resource and confirm that the extraction will be straightforward and economic. O'Connor gave more details: "In this rock that has 3,500 ppm lithium, we get 80% of the lithium out by using warm sulfuric acid. Our solutions have 2,500-2,700 ppm lithium in them, as opposed to 250 ppm in a normal brine."

FERTILIZERS

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



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One of the juniors in the area is Crops Inc. (previously Focus Ventures) with the Bayovar 12 project. The company carried out recent beneficiation tests that showed a minimum of 30% P₂O₅ content in their rock. With these results, the company has been able to sign MOUs with two phosphate rock merchants based in Switzerland, defining specific export destinations for the traditional phosphate fertilizer industry.

The shorter-term view for Crops Inc., however, is different. Its president, Gordon Tainton, has been looking at different methods to add value to the Bayovar 12 product given the low global phosphate prices: "We believe we have a genuine opportunity to produce elemental phosphorus (P₄). P₄ is one of the main materials used to make the Roundup weed killer. We investigated the North American and European markets and found out that all P₄ demand for North America, Eastern and Western Europe is covered by imports from China and North Vietnam," explained Tainton.

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

GrowMax Resources' asset, the Bayovar property, is also located in the same region in northern Peru. The company's initial proposal was to develop a potassium chloride operation out of potash brine. Further studies have concluded that the asset was more suited to become a sulphate of potash (SOP) project. Furthermore, the company discovered approximately 500 million mt of fairly high-grade near-surface phosphate. For this year, GrowMax is focused on generating cash-flow and has decided to invest its time and resources in the development of specialty fertilizer assets in Latin America. Stephen Keith, president and CEO of GrowMax, sees huge potential in the region with Peru's agricultural exports looking to double by 2021. The SOP project, however, needs to improve its numbers: "The initial results of the EPC study were not as good as we

were predicting; the after tax IRR was not so attractive. The capex was set at US\$20 million for a 5,000 mt/y SOP operation. We are now optimizing the project with the view of taking a production decision during 2018, while we are in discussions with potential partners to develop or finance the project."

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

With the world's population increasing and the decreasing availability of arable land, it will probably be a question of time until supply and demand dynamics for phosphate push its price upwards. When that happens, Peru will be in a perfect position to further develop its resources in the Sechura basin. ■

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Multi-Commodity Exploration Potential

“The skarn mineralization at AntaKori is often associated with porphyry systems. Peru is one of two countries globally, along with Indonesia, with extremely large skarns, like Las Bambas and Antamina. We anticipate that we will find a porphyry driving the system at some point.”

John Black, CEO,
Regulus Resources



“Our 2018 drill campaign consists of 15,000 meters, targeting new zinc discoveries and extensions of Central, South and West Ayawilca. We will have a resource upgrade in parallel to a detailed metallurgical study, and then we will complete our PEA over the second half of the year.”

Graham Carman, president and CEO,
Tinka Resources



“We have 124 million pounds of uranium and 176,000 mt of equivalent lithium oxide. Now, as we move west towards the Falchani area, the focus is increasingly on the lithium, because the new resource is expected to be one of the largest lithium resources in the world.”

Laurence Stefan, president and COO,
Plateau Energy Metals



“I believe that in the long term there is an upward trend in the fertilizer space. At GrowMax, we will have to grow out of Peru as the project has a huge possibility to expand. Our focus is on creating a real project with near-term cash flow.”

Stephen Keith, president and CEO,
GrowMax Resources



A vertical banner for GrowMax Resources Corp. The top part features the company logo, which consists of a blue circle with green curved lines around it, and the text "GROWMAX RESOURCES CORP" in green and white. Below the logo, the text "GROW WITH GROWMAX" is written in large, bold, white and green letters. Underneath, there are three sections of text: "FOCUS ON SPECIALTY FERTILIZER IN LATIN AMERICA", "PHOSPHATE World Class 430 MT Inferred Resource", and "POTASH 4.9 MT KCl Inferred Resource". The bottom part of the banner shows a photograph of two men in white hard hats and light blue shirts looking at a large white sheet of paper (likely a blueprint) outdoors. At the very bottom, there is a green section with white text: "Stephen Keith President & CEO", "info@growmaxcorp.com", "+1-416-323-5782", and "www.growmaxcorp.com".

Engineering: Sharpening up Projects

An overview of the latest industry trends with the main consultancy houses involved in Peru's mining sector

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

As investment returns, engineering companies need to expand again, but the question that remains is by how much? Federico Schwalb, general manager of Buenaventura Ingenieros (BISA), provided an example of the growth engineering companies are experiencing: "In 2017, we prepared more than 200 mining proposals for a total value of US\$51 million. Of that, we were

awarded a bit more than US\$10 million. This year, just between January and February, we have already presented 80 proposals worth US\$15 million."

PUBLIC WORKS ON HOLD

The Lava Jato corruption scandal has caused many public projects to be delayed in Peru, therefore the enhancement of mining activities has been welcomed by engineering firms that work both in the private and public sector. Stantec has finalized the merger with MWH and this has brought synergies between MWH's water management expertise and Stantec's underground mining capability. During 2017, Stantec were hopeful for certain government contracts, but projects like *Agua para todos* (Water for Everyone) did not proceed on the grounds of political instability.

During the downcycle, the former MWH put a strong emphasis on diversification. Looking forward, Alberto Coya, country manager at Stantec, is still interested in water, power and public sector projects in Peru. However, mining currently represents 85% of the company's project portfolio, with a vast majority of those assignments being in brownfield operations.

In spite of the increasing demand coming from mining, BISA is also looking at further diversification: "We expect a lot of activity in hospitals, schools, roads and irrigation projects," said Schwalb. This also involves working in projects that are indirectly related to mining, such as some railroad projects that are in the studies phase. "Once these studies are done, the expectation is that companies in the south like Strike Resources, Las Bambas, Hudbay Minerals and even Southern Copper with Los Chancas, will see if they are interested in forming a partnership to develop a railroad project," explained Schwalb.

MINERS IN A RUSH TO ACT?

Paul Murphy, manager for South America at Mining Plus, an Australian consultancy, has seen the Peruvian market stabilise this year: "From 2013 through 2016, we observed many companies cutting back on greenfield and brownfield investment, electing to simply optimize their current operations. Throughout 2017, there was a distinct change with bigger greenfield and brownfield study scopes (Exploration, PEA, PFS and FS) returning to the market." As a result of these developments Mining Plus, which built its office in Peru around a base of QPs in exploration, is aiming at doubling its team this year. When discussing whether he believed

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companies would rush to drill, Murphy said: “The mining cycle is driven by fear and greed. Companies have been fearful and conservative for the past three or four years, and now the sentiment is changing very quickly to one where they are fearful, but in a completely different way. Fearful that if they do not act immediately, they will miss out on this coming cycle of higher commodity prices.”

The geological practice is also one of the main drivers of SRK Consulting’s business in Peru. SRK’s director Antonio Samaniego suggested that the new positive mining cycle should translate into higher levels of work across the board. Particularly in geology, he emphasized SRK’s effort to develop its structural geology group with the support of SRK’s offices in Canada and the U.K.: “All mineral deposits occur through the geological faults, and structural geology looks at finding the mineral enrichment zones. It is an interpretation of how the deposits were formed. Before, this methodology was used for geotechnical work, but we are now applying it to exploration. We are setting up a department to see how we can benefit from this, especially in the narrow-vein mines we have in Peru,” Samaniego said.

OPERATIONS SPECIALISTS

During the downcycle, certain consultancy firms transitioned from being a provider of EPCM or capex projects to become specialists in opex, due to the lack of new mining projects being developed worldwide. With tight budgets, mining players needed

“One of the first discussions we have with our clients is what the potential footprint could be. Solutions such as using an old pit facility to receive tails or waste, and using dry stacking, filtering, and a mixture of conveying and trucking, are all being implemented.”

Gustavo Bravo,
Mine Waste
Division leader
Latin America,
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to debottleneck their operations and incorporate efficiency improvements to sustain their business model. Pierre Montauban, country manager at Hatch, believes that his company discovered a niche in operations, and wants to continue expanding in this sector before competition increases. “For the expansion of Antamina, the ramp up only took three months, much faster than the average time. Las Bambas was more complicated but still only took five months, which is world-class for an operation of that size,” he related.



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With 95% of the Peruvian business in mining, Hatch Peru has become well known across the wider organization for its work in operational readiness. Alfredo Remy, regional director for Advisory and Business Improvement at Hatch, gave more details about this service line: “Our operational readiness supports clients at the point of handover from the entity supervising the construction, to effectively start-up, ramp-up, then operate and maintain the facility, reaching nameplate capacity as planned.”

THE RETURN OF EPCM PROJECTS

Poor performance in engineering, procurement and construction management (EPCM) projects during the supercycle led to cost overruns and lengthy delays to reach commercial production. This, coupled with the sudden fall in commodity prices, prompted mining operators to look for cheaper alternatives to carry out their investment projects. In the words of Alexandra Almenara, general manager of SNC-Lavalin: “The downturn in mineral prices in the last few years has taught us lessons as we have had to struggle with less resources to deliver projects.” Víctor Anyosa, general manager of EPCM Experts, a local firm, explained how mining companies have changed the way they execute their projects: “They are trying to visualize the project from the early stages, and they are transferring the risk to other companies such as the construction company, through the provision of small EPC contracts.”



Water monitoring at Corani. Photo courtesy of Bear Creek

Indeed, for a while, smaller EPCs became the name of the game, but the savings of that model were often offset by the lack of integration between the different modules of the project, causing –again– delays, inefficiencies, and higher costs than originally budgeted. Denys Parra, general manager of Anddes, one of the largest Peruvian engineering firms with a team of 250 people, certainly sees future projects returning to the traditional EPCM approach: “In general, I see the EPCM model coming back, however, low cost will continue to be an obligation moving forward. The only way this will change is if there is a multiplicity of projects that would generate a shortage of engineering capacity.”

With this in mind, the traditional EPCM players keep their eyes open for potential opportunities as Peru unlocks its investment pipeline over the next couple of years. SNC-Lavalin, a company celebrating its 25th anniversary in the country, expects to grab an EPCM opportunity after a few years where they had to gear more towards environmental, social studies and permitting work. Alexandra Almenara said: “Depending on the specific requirements for the project, we try to find the right experts in SNC-Lavalin from around the world. For copper we can bring resources from Chile, for gold from Australia or Canada, and for material handling usually from Brazil.”

SYNERGY AND M&A

Synergy became a key concept in the downturn as companies and offices brought together their diverse range of expertise in a bid to not only survive, but grow. Companies merged, and regional offices began to collaborate more. Hatch not only pushed for synergy between its Chile and Peru offices, but also acquired Indisa in Colombia. With each office having a specialty, they are working in collaboration to maximize their growth potential as efficiently as possible.

A company that has entered the South American market aggressively is WSP, with three important acquisitions: Schlumberger

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Water Services, Poch (Chile) and ConCol (Colombia). When discussing synergy, Andrés Fernández, country manager for WSP said: “Schlumberger’s consultancy expertise on one side, and Poch and ConCol’s engineering background on the other, greatly complement each other.” Other global firms have also strengthened their in-house capabilities through acquisitions. Last year SNC-Lavalin, for instance, completed the acquisition of Atkins, an 18,000-people strong consultancy firm with a reputation for its digital engineering innovation capabilities. On a smaller scale, SRK Consulting, which merged with SVS Ingenieros in Peru a few years back, is now using the team from the former Mine Ventilation Services (MVS), a company it acquired in California, to carry out all the work related to ventilation in Peru’s underground mines. “We are bringing a lot of expertise from this company,” said Antonio Samaniego of SRK. “In Peru, you have some small ventilation companies, but through MVS we have exposure to much deeper mines from Canada and South Africa.”

THE IMPORTANCE OF WATER

Water has been a constant topic of conversation in Peru due to its scarcity in certain mining areas and the country’s climate variations. Moreover, there are now greater demands from the different stakeholders to improve water management. Specialized firms are constantly aiming to innovate their service line, not only to be more cost efficient and productive, but also to be environmentally friendly. Golder, for instance, recently unveiled its new corporate identity, and has been expanding its mine water group in Peru, with 30 people today dedicated to this area in Lima.

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

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Charles Vuillier, principal engineer at ATC Williams, an Australian firm specialized in tailings and water management, provided more insights about the water balance: “A deficit of water can be problematic in an arid country, and the cost can be difficult to control; it can range from US\$2 to US\$5 per cubic meter of water. If there is an excess of water, then there is a safety issue, such as water going over the tailings storage facility or seeping into the ground, therefore polluting the aquifer.”

TAILINGS MANAGEMENT

“In Peru, the design of any mining facility presents significant challenges due to the difficult topography, the seismic activity, the high levels of rain, the high altitude and other factors”, said Denys Parra of Anddes, who pointed out that, while Peru has not had any major dam disaster like the one in Samarco in 2015, the industry needs to raise the bar: “A tailings dam failure is always terrible news, no matter if it is a small leak. The environmental impact of this may be small, but the effect on the mining industry’s reputation is very important. We have recently seen dam failures in Australia and Canada, countries meant to have the highest standards. This is not acceptable,” he continued.

One of the challenges presented by tailings management is the large volumes that need to be handled. New environmentally-friendly technologies to enhance safety and improve water recovery are yet to prove an economic case for the larger

“A tailings dam failure is always terrible news, no matter if it is a small leak. The environmental impact of this may be small, but but the effect on the mining industry’s reputation is very important.”



Denys Parra,
general manager,
Anddes

operators. According to Gustavo Bravo, who recently joined Golder to lead its mine waste division practice in Latin America: “In the future, filtered tailings will be the solution for the issue of mining waste in larger operations, but globally there is still not a great deal of experience in processing and filtering large volumes. I think there will be a natural process of maturity for the technology to reach the point in which it is a more viable solution.”

REDUCING THE FOOTPRINT

Beyond the environmental and safety implications of handling large volumes of ore, waste and tailings, a key aspect is the increasing space limitations that mining companies face. This has a number of implications, from the size of the facilities as such, all the way to project efficiency and environmental and social issues. Víctor Anyosa of EPCM Experts said: “Going for functional designs is essential to optimize the capex. If you do big industrial complexes with large steel structures, you create a monster that is going to cost a lot of money. If you do not have a large budget, you need to adapt the design to make the project competitive.”

For Gustavo Bravo of Golder, looking at the footprint means performing the necessary trade-off studies between the existing technology alternatives: “Solutions such as using an old pit facility to receive tails or waste, and using dry stacking, filtering, and a mixture of conveying and trucking, are all being implemented. As consultants, one of the first discussions we have with our clients is what the potential footprint could be, as well as what is the possibility to expand land rights outside the current boundaries.”

Bravo insisted that social and environmental considerations are fundamental, a point also raised by Gerardo Leunda, partner at ERM, an environmental consultancy: “We are aware that, in projects like Michiquillay and Quellaveco there are certain stakeholders that are not favorable to these investments. The calendars of mining companies do not coincide with the timelines of the communities, so that needs to be harmonized.”

“The biggest challenge, more than the technical aspects, is to be able to establish good relationships with the different stakeholders early on,” Leunda concluded. ■



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Contractors-in-Waiting

Project executors eagerly await the transition from the studies and the early works to the development of multi-billion dollar projects

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

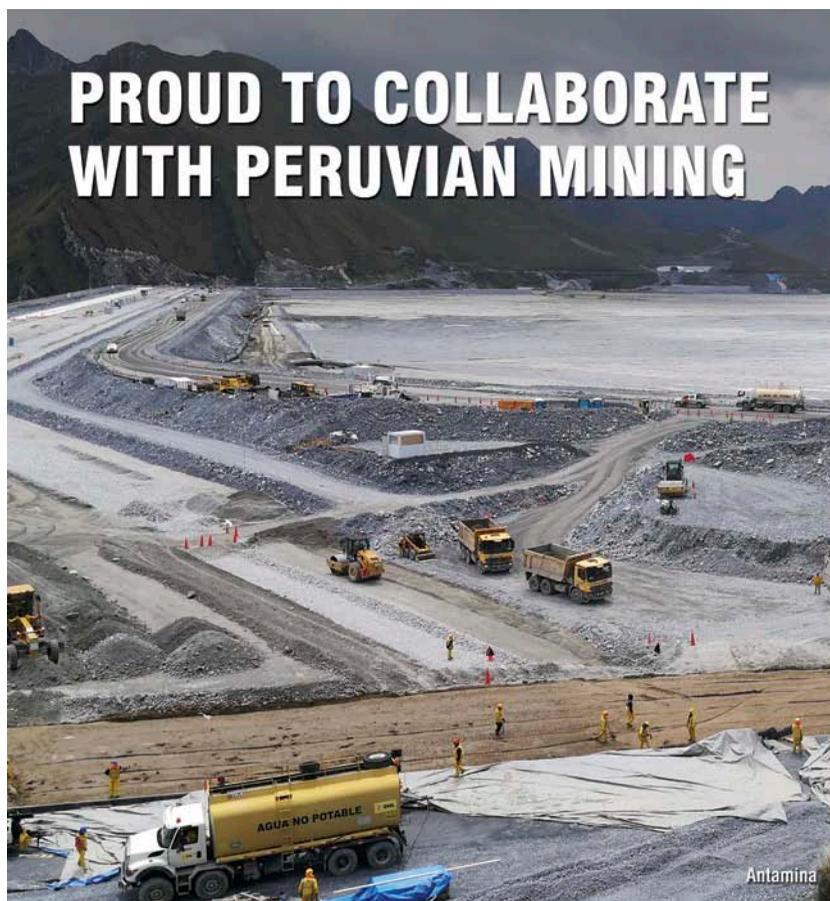
OHL, which arrived in the mining sector in 2012, has expanded its range of action. "In the past, the market probably saw OHL as a company focused on earthmoving, but we can do much more than that. For example, we are currently executing three tailings dams' contracts, none of which are for earthmoving,"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

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

sources and Anglo American. Ricardo Vega, president of OHL, highlighted that mining generated 77% of OHL's construction revenue in Peru last year. As an example of OHL's capabilities in value-added services, the company recently completed an EPC project for the crushing, agglomeration and transportation facility for Tahoe Resources' Shahuindo project in Cajamarca. "Thanks to OHL's procurement capabilities, we can adapt the crushing systems, conveyor belts and grasshoppers very well to the needs of the client. It is a tailor-made solution," said Vega.

STRACON, until recently part of the Graña y Montero Group, has started a new phase under new shareholders, namely Ashmore

Group and Steve Dixon, the company's CEO. Dixon affirmed that the recent transaction will allow STRACON to enter new business areas: "We will remain focused on our core business, which is contract mining and bulk earthworks in Latin America. However, we now have an opportunity to broaden our service offering and implement further geographical diversification." As an example of STRACON's capabilities, Dixon spoke of their work at Cobre Panama: "There, we already provide a number of services outside of our core activities, including the construction of the transmission line, a tunnel and mechanical and piping installation for both the power station and the concentrator". In Peru, the



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company handles the contract mining operation at Tahoe's mines and is also doing construction for the tailings facility at Constancia. STRACON has a goal to replicate the US\$460 million it had in sales in 2014 by 2020, and for that it is open to sign joint ventures and acquire new companies in the region as well.

THE SOCAVÓN OPPORTUNITY

Moving forward, both OHL and STRACON want to increase their participation in underground mining: "We have very strong expertise in tunneling for civil works, but we have never applied that expertise to an underground mining operation," said Martín Fernández of OHL.

Meanwhile, STRACON is already present in underground mining in Colombia, at Red Eagle's San Ramón gold operation. Underground mining, however, still represents less than 10% of STRACON's business.

The issue for large contractors looking to enter the underground space is that most of the current underground mines in Peru are in the small to medium size range. The

"45% of our business is conducted outside of Peru, as opposed to 15% in 2014. That was our peak year for sales, with \$460 million. We have a target of reaching that level again by 2020, but this will require geographical and service diversification."

Steve Dixon, CEO, STRACON



country's largest underground operation is Cerro Lindo, with a daily processing capacity of 20,000 mt/d. The expected large underground projects will probably come from ageing open pits, like Yanacocha or, eventually, Antamina. Another interesting underground project is Glencore's Corocohuayco, where development work has already started.

In light of these developments, different players are already taking positions. Chilean company Mas Errazuriz, for instance, expects the Peruvian market to replicate the conditions of Chile's large underground

mines soon. Diego Morales, general manager of Mas Errazuriz in Peru, said: "In Chile, mining companies look for a full-service contractor. Luckily, in Peru we start to see a move towards that model, with one single contractor that has strong financial capacity and higher safety standards."

Mas Errazuriz is executing the diversion of the Asana river at Quellaveco, whilst also working in Fruta del Norte in Ecuador for Lundin.

INCREASING STANDARDS

JRC Ingeniería y Construcción, a Peruvian underground contractor, has grown over the years to provide integrated underground services. As part of this evolution, the company obtained the triple certification two years ago, and today has six running contracts around the country. Wilder Ruiz Conejo, president of JRC, explained that the company's strategy is also related to potential diversification, considering that JRC's history actually started in construction work: "Looking at the long term, we want to consolidate our growth through integrated underground contracts, based on our experience in this field over the last 10 years. Moreover, we are developing related business opportunities, with construction services. This way, we hope to re-start doing earthmoving and infrastructure work, as well as other projects in tunnel excavation for roads and hydropower plants." Another underground contractor that has set foot in the country is Byrncut, through its partnership with local firm San Martín. The Australian company's business plan is to target underground mines that will require production faces of five meters by five meters, therefore large volumes.

Greg Jackson, managing director of Byrncut Offshore, emphasized that the use of the latest technology is key when you

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are dealing with such large equipment underground: "Byrne cut invests heavily in innovation, developing practical solutions. Examples include real-time 3D scanning technology to measure shotcrete thickness and minimize wastage, mechanical fan hanging devices to improve safety, and modern ejector trucks and R&D in alternative underground truck technology."

Ruiz Conejo of JRC agreed on the need for further mechanization and digitalization: "From our perspective, the only way to bet on the upcoming opportunities is to incorporate the latest technologies across all processes to execute massive exploitation methods. Related to this is the need to train all our people to be able to manage large-scale operations."

SAFETY ASPECTS

The aforementioned trends for larger underground mining also provide for a safer working environment. While achieving economies of scale and incorporating the latest technologies may imply a bigger initial investment, this will pay off in the long

run, said Morales of Mas Errazuriz: "Many see safety as an expenditure, but safety is an investment. With a safe environment, productivity rates will increase. If the industry continues moving towards the integrated contract model, not only productivity will increase, but also the overall safety records in the country."

Local contractor Pevoex is also closely involved with the safety aspects of mining operations as the core business of the company is drilling and blasting services. Its general manager, Rómulo Mucho, raised a problem that is costing a lot of time and money to contractors: "In Peru we have not standardized the induction procedure to go to the different mines. There is a whole system around it which involves a lot of medical providers and a lot of money. Chile has already solved this issue, but we have not," he said.

Mucho, who was also president of Peru's Institute of Mining Engineers a few years back, assured that the implications of this also reach the training programs of young people across the industry: "This lack of

standardization also prevents students to do internships in the mines, because the induction process takes more than a month and it is simply not feasible for them."

Beyond drilling and blasting, Pevoex has also expanded its service range to provide general earthmoving works, including tailings dam expansions, as well as construction of explosive storage facilities. Mucho was critical when asked about the main challenges for mining investment in Peru: "The main enemy of Peru's development is the State itself. Considering all the permits needed to make an investment, we need to solve the issue of moving licenses in a timely manner –otherwise, it is impossible for the country to move forward. We cannot give carte blanche to the mining companies, but the system should be much more friendly, with less permits," he said.

A LEVEL-PLAYING FIELD

If corruption has proven to be a deep problem for contractors when trying to win projects for public institutions, Peru's very open market for private investment pushed com-



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Ricardo Vega,
president, OHL



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Wilder Ruiz Conejo,
president, JRC

petition to the limits during the downcycle, when outsiders were desperate to win their first contract in the country, and clients were looking for the lowest costs possible. Cristopher Varas, general manager of Grupo Vivargo, a local lifting and installation specialist, saw a number of its construction clients affected by the Lava Jato scandal, and also had to face very aggressive competition from outsiders. He related: “When the rates go below the average, you know that something is wrong. In Chile, companies really make sure that no-one offers a price that would result in safety issues later—in Chilean tenders you have bottom-line prices below which you cannot even participate.”

Varas said that during the crisis he saw providers offering a 50% discount on the market average, especially foreign companies that just wanted to enter the Peruvian market. “At the end of the day, Peruvian companies that invest locally and obtain

financing through the local bank lose an opportunity.”

Luckily, there seems to be light at the end of the tunnel, thanks to the reactivation of mining investment which has allowed Grupo Vivargo to have a 90% occupation rate in its equipment rental fleet. “We are doing quite a lot of maintenance projects, and we are also seeing good levels of activity in Chile, which creates synergies and allows us to move the equipment between the two countries depending on the demand”, said Varas.

Beyond its lifting and installation equipment, Grupo Vivargo also offers project logistics with heavy and oversized cargo services, while a third business line is related to warehouse and inventory management in the mines.

UNDERGROUND NICHES

Beyond the potential for large-scale underground mines discussed above, Peru

already has a rich history in underground mining, with a wide variety of operations from the very small narrow-vein mines to highly mechanized medium-sized operations.

Robocon, one of the key contractors offering rock support through shotcrete application, is currently focused on narrower tunnel development, as per its clients' demands. “Typically, our clients have faces of four by four meters, but now they want to advance in tunnels of three by three meters [...] Through Tecnomecánica, our technological arm, we are developing new machines in collaboration with other manufacturers in Peru and abroad that already have some technologies for narrow-vein operations,” said Enrique Sattler, managing director at Robocon.

Robocon has been working for Volcan (now Glencore) since 2005 and for Pan American Silver's Huarón and Morococha mines since 2012. When discussing Robocon's



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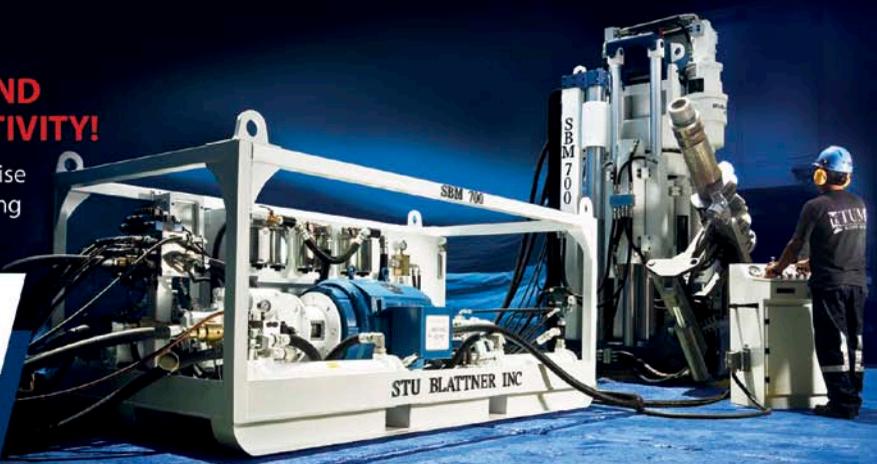


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most recent activity, Sattler commented: "We started operations in Tambomayo and Uchucchacua for Buenaventura, and we began working in Yanacocha in 2017, in collaboration with AESA. Our most recent client is Sociedad Minera Austria Duvaz, where we are transitioning from a dry shotcrete operation to a mechanized, wet shotcrete operation, in narrow tunnels."

Sattler stated that further milestones for this year will include Robocon's development of its own scalers.

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

In 2017, Tumi grew from 11 to 15 crews, three of which are dedicated to production activities, and is also expanding into Chile, where the company expects to grab boxhole contracts with Codelco at El Teniente. As a company that engineers and develops its own machines, increased mining activity worldwide may result in more revenues coming from the outright sale of equipment to miners, commented Blattner: "We will see Tumi's growth coming not just from contracting, but also selling machines into the Peruvian market, which so far we have tried not to do. It seems that the mines are going back to the mentality of the 1970s inasmuch as they want to buy their own equipment again. We are flexible enough to offer to run the equipment ourselves with a contract, or provide all the maintenance, and also to train our clients' operators if required."

Finally, Master Drilling of South Africa is also expanding its service scope through the development of new equipment, with the aim of not being limited to

vertical development only. "In a typical underground mine, the vertical development that we do in raise boring only represents 5% of the total development. If we want to grow as a company, we need to start focusing on horizontal development, which is tunneling," said Gareth Sheppard, COO of Master Drilling.

At Mining Indaba, the company unveiled a new mobile tunnel boring solution called the MTB. "We believe that this is going to revolutionize the way mining is done. If you take a normal tunnel-boring machine, it has a 200-meter backup system, whereas our technology is modular, with 20 meters for each module. It is going to be a quicker, continuous process, with less ground support," assured Sheppard.

Master Drilling currently has 23 working raise boring rigs in Peru, and has been recently focusing on a new solution to do raise bores in areas with poor ground conditions. The new tunneling solution is still to be tested, with an initial prototype able to drill tunnels of 4.5 meters in diameter. ■



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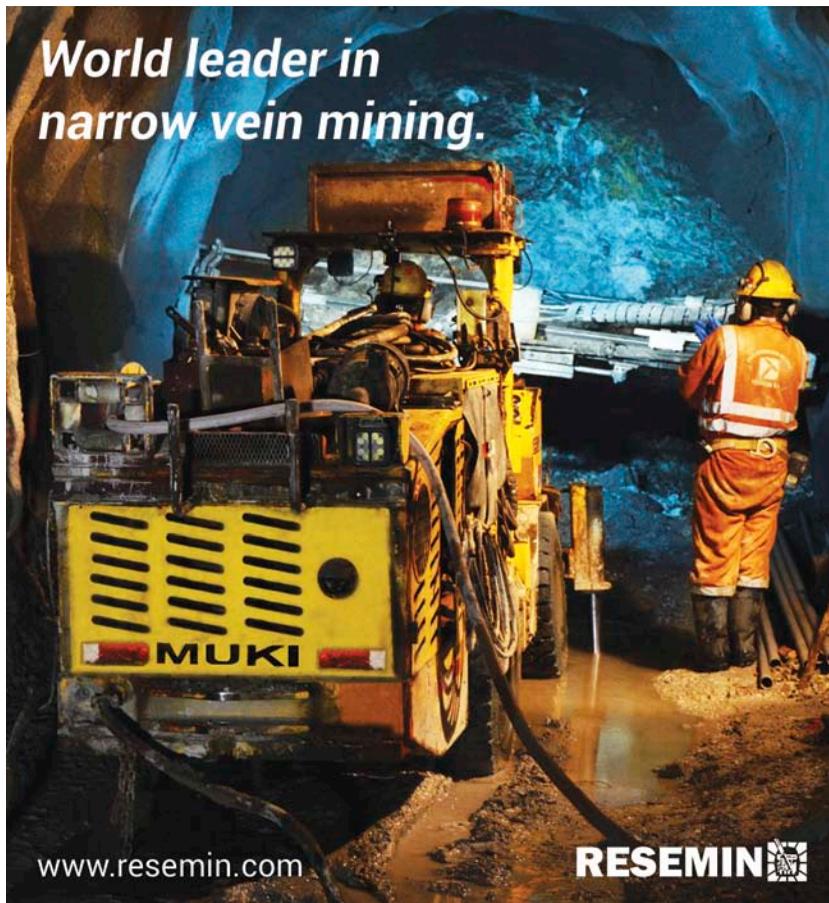
The mining industry is constantly evolving. If the last downcycle was fertile ground to look for new ideas that would bring more efficiency to production processes, the current upswing in commodity prices may offer the perfect opportunity to properly test those new technologies. At the end of

the day, there is more cash available in the market, and final users may be a bit more flexible with their budgets to give the latest gadgets a try.

For the global original equipment manufacturers (OEMs), innovation is a long-term pillar with a clear strategy. Epiroc,

the newly-created company that is taking over Atlas Copco's mining business, has defined four areas of interest for innovation: electrification and the use of battery-powered equipment; automation, related to the possibility of having remote operations; interoperability, with all machines compiling big data that will allow for fast decision-making; and technologies for rock excavation, with the idea of potentially replacing drill-and-blast methods with continuous mining techniques.

Ángel Tobar, general manager for the Andean region at Epiroc, developed on the advantages that battery-powered equipment can bring to the mines, especially as underground operations move deeper and health, safety and environment (HSE) regulations worldwide become more stringent: "At this moment, the initial cost of a battery-powered machine is higher, but if you look at the total cost of operation, you can obtain significant savings in areas such as mine ventilation, by having smaller tunnel sections, and also you would avoid the operational delays related to fumes underground," he explained. Atlas Copco chose Peru to do the global launch of the battery-powered Scooptram ST7 at Southern Peaks' Condestable copper mine. Now, under the Epiroc brand, this machine is running its first tests in altitude conditions at Nexa Resources' Atacocha operation. Besides the Scooptram, Epiroc already has battery-powered Dumpers, Boomers and Simbas for production drilling.



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RESEMIN

Komatsu Mining Corp., the company created from the merger of Komatsu and Joy Global, is also in a great position to push its technological developments across a wide variety of machines involved in mining, from the Komatsu trucks and construction equipment to the P&H shovels, Joy underground equipment and Montabert drills. Carlos Fonseca, general manager of Komatsu Mining Corp. in Peru, gave more details about the SR (Switched Reluctance) technology included in the P&H wheel loaders and the larger Joy underground loaders: "It consists of the ability to recapture energy when you put the brakes on, like in hybrid vehicles, or when you lower the bucket. This energy can be applied to propel the wheels. The feedback we have received is that it is very fuel-efficient and low on maintenance. This technology is targeted to be included in other Komatsu products in the future."

NEW PROJECT OPPORTUNITIES

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

New mining investments also represent great opportunity for manufacturers specialized in construction equipment. Volvo Peru, for instance, offers the FMX trucks, widely used in earthmoving activities, as well as the whole range of its Volvo Construction Equipment line. In 2014, Volvo acquired the mining truck business of Terex, and starting this year, these units will be sold under the Volvo brand for the 45 to 100 short ton range. "2017 was very positive as we sold to key customers that already had Volvo trucks but not Volvo construction equipment. In 2018, we expect a positive continuation of this trend with a favorable mining environment and the commencement of new projects like Quellaveco. Even in underground mines, where we do not have a strong influence,

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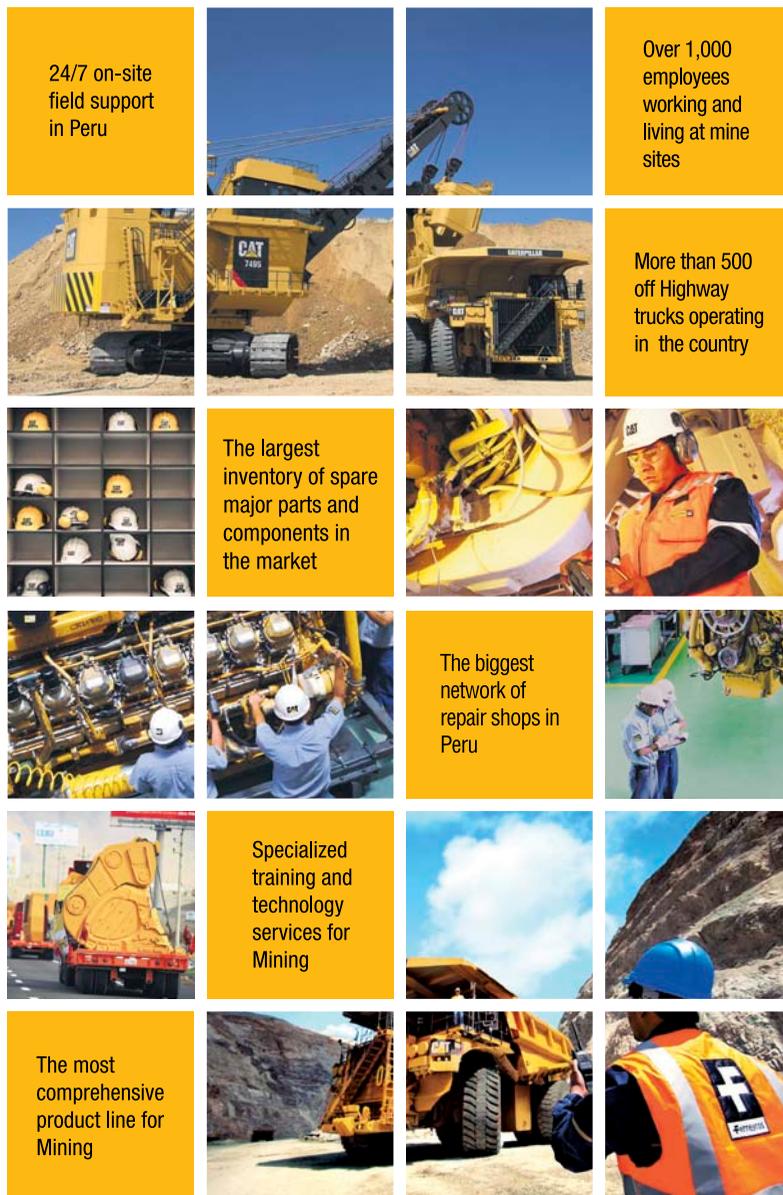
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“Our SR technology consists of the ability to recapture energy when you put the brakes on, like in hybrid vehicles, or when you lower the bucket. It is very fuel-efficient, low on maintenance, and is targeted to be included in a variety of Komatsu products in the future.”

Carlos Fonseca,
general manager,
Komatsu Mining
Corp.



we are selling our product range to the communities that rent equipment to the mines,” affirmed Enrique Ramírez, VCE business director at Volvo Peru.

Looking specifically at dump trucks for construction, the market is finally picking up after several years of consistent decline. José Antonio Heredia, manager of the truck division at Divemotor, the distributor handling Mercedes-Benz, gave some figures that indicate a better business climate: “Although 2017 closed with just 900 dump trucks sold in Peru, the negative trend has

finally been reversed. During the peak moments, the industry bought 2,500 dump trucks annually. In 2018, we should be at a level of around 1,000 dump trucks.”

Divemotor has recently launched the new Actros model by Mercedes-Benz, designed for transportation activities, while there is a new truck coming up for earthmoving and off-road requirements, called the Arocs. Heredia provided an update about the new features of this model: “The new Arocs includes the Turbo Retarder Clutch, a hydraulic system that gives the driver greater reliability to overcome the steepest inclinations when the truck is loaded. When going down a slope, it acts as a retarder, giving stronger and faster braking capability. The system allows for an average higher speed, which means that the cycle times are reduced, and therefore productivity increases.”

UNDERGROUND EXPANSIONS

The improvement of the market has clearly been felt across the underground spectrum. Indeed, higher base metal prices have drastically improved the economics of many mines, encouraging operators to engage in more dynamic budgeting after years of severe cuts in investment. Normet, a Finnish company specialized in underground equipment, had good results in 2017, according to Franklin Pease, its general manager in Peru: “We started to see many companies renewing their fleets, activating the investment programs they had put on hold during the crisis.”

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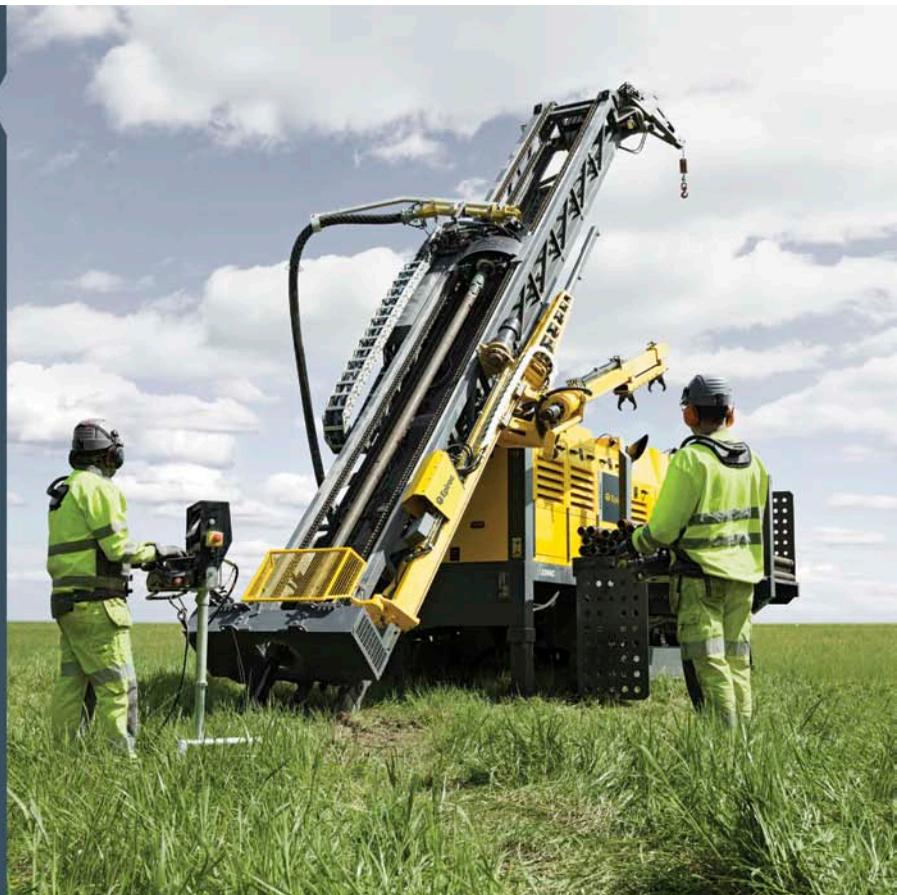
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Normet is mostly known in Peru for its Alpha 20 shotcrete sprayers and its Tornado shotcrete mixers, but the company offers a wider portfolio of solutions that go hand-in-hand with the mechanization of underground mining. Peru's latest safety regulations oblige operators to mechanize certain processes, such as scaling or certain jobs at height, where Normet's range of equipment can be of help.

Pease affirmed that innovation and mechanization have certain limitations, especially in narrow-vein operations: "When you have small tunnel sections, you do not have all the equipment you need to mechanize the operations. Narrow-vein mining is a very small percentage of the total underground mining in the world, but we need to adapt to the different needs of the market [...] Changes will happen sooner or later: as an example, most mines will mechanize the charging of the explosives, because you will reduce the amount of explosives needed."

The lack of mechanization in narrow-vein operations opened up a business niche that the very large OEMs probably did not find to be large enough for them. Yet, it is a significant market worldwide. Resemin, a Peruvian manufacturer of underground equipment, has specialized in exactly this segment, and is capitalizing on its innovation efforts to achieve dramatic growth rates (50% in 2017) as the mining market picks up. Resemin produced 92 units last year and the company has expectations to reach the 150-unit/year mark soon. For this, however, the company will have to set up additional manufacturing capacity, as its 9,000-square meter plant in Lima is already working at full speed. "Our most successful product lines are the roof bolters and the Muki," related James Valenzuela, CEO and chairman of Resemin. "There is now greater demand for equipment for smaller tunnels of 3 meters by 3 meters, this is why the Muki is constantly described as a game-changer. We are the market leader in narrow-vein machines and the Muki is the complete solution for that sort of environment in the fact that it has four applications: drilling, scaling, roof bolting and cut-and-fill mining. It can quadruple productivity compared to a manual drill."

Another important milestone for Resemin's corporate growth was its purchase of Schopf, a Stuttgart-based manufacturer of underground loaders. With this acquisition Resemin received all the technology and engineering capability of Schopf as well as the brand, and now the company will begin manufacturing Schopf loaders in Peru, initially the 3.5-mt payload model and will progressively move up the product range to the 18-mt payload loaders. Valenzuela emphasized that now Resemin has the full offering: "We have a complete line of products for underground mining, and the loader market is three times the size of the market for drilling rigs. It is an enormous growth opportunity for us."

ANCILLARY EQUIPMENT

Sullair del Pacífico, the company that distributes and services the Sullair compressors in Peru, is also expecting growth from the mining industry. Its general manager, Richard Rodríguez, explained that compressors are present across most mining and industrial processes, from the point of mineral extraction to the processing plant. "Compressors represent a small investment if compared to other capital equipment, but they are a critical



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element of the whole process, because if you have a compressor failure, you need to stop production,” he explained.

Globally, Sullair was recently acquired by Hitachi, and Rodríguez affirmed that the merger is going to create very interesting synergies: “Hitachi has a whole set of solutions in terms of remote monitoring, connectivity and others. The combination brings the best of both worlds. American equipment has always been very robust, while Japanese companies are experts in introducing the latest technologies.”

Sullair’s TS line is the flagship for mining, and the company has more than 300 of these working in Peru. The next evolution of that model is the LS series, with more technology to monitor the machine’s different parameters, that Sullair del Pacífico wants to market more aggressively with the larger mining customers. The company has also obtained the local distribution of Kito, a material handling equipment specialized in cranes and hoists, to complement its offering to mining and industrial customers.

EQUIPMENT COMPONENTS

The development of new projects will have an effect on expanding the different fleets across the board, offering opportunities as well for companies specialized in equipment components. Fundición Chilca (FUCSA), a recent new foundry investment in Peru, has set up capacity to provide items for both processing plants and mobile equipment. “During the downturn, the price of mill liners went down significantly,” related Raúl Ferrero, general manager of FUCSA. “We expect that to change in the near future, but in the meantime we are focusing on other products.”

This is how the company has secured contracts with international OEMs and multinational mining companies. Product-wise, beyond mill liners, FUCSA has specialized in manganese-based products, crushers and components for the large mining shovels. Ferrero said that the business has improved in parallel with better commodity prices: “Mining companies are currently investing in ad-

ditional inventory of parts to ensure that they do not have any production stoppages. Also, they are reopening the operations that were not profitable during the downturn.”

Being a relatively new foundry with modern technology, the company has been able to accommodate larger equipment (it can produce pieces of up to 20 mt), while also investing in R&D. According to Ferrero, the company has developed several types of manganese, chromium-molybdenum and white iron alloys.

Specifically in the mining truck segment, Austin is a company specialized in the design and manufacturing of truck bodies and buckets and counts more than 130 truck bodies operating in different mines around Peru. The company’s latest product is the JEC LD tray, that fuses the best of Austin’s JEC and Westech designs. Tim Mitchell, VP business development South America at Austin, gave more details about this product: “There is a lot of engineering behind the steel. We have optimized the JEC LD by reducing the tray weight, which has a significant effect on the payload. Over the long run, the difference in productivity is huge, and can result in production increases in the millions of tonnes.”

The JEC LD is already working in Colombia and Peru, in operations including Cerro Verde, Southern Copper, Constancia and Shougang.

Another important part in mobile machines and industrial equipment is the drives. Bosch Rexroth, a German company with a leading position in hydraulic drives, has been expanding its service capability in Peru over the last years, through the acquisition of a local distributor and the setting up of a new service shop. Now operating as a new legal entity in Peru, the company will continue capitalizing on the after-market opportunities (many mining machines arrive in Peru with Bosch Rexroth components already installed), but also will push for the introduction of new solutions locally. Kai Rothgiesser, general manager of Bosch Rexroth, explained that the company sees a lot of opportunity in Industry 4.0: “By recording all the parameters of the different machines and components, you can make sure that the operation is run-



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“Recovering all the water that you take from the earth is the future of mining; that means having a mine with no tailings dams. While many operators still see this as being too expensive, new regulations and demands from the local communities will increasingly push companies in this direction.”

Jesús Cabrera, general manager, FLSmidth



ning at an optimal level and that you can anticipate maintenance. These sensors, and the wiring and software associated to them, are not a big investment for the client if you compare it with the benefits you can obtain. We sell all these components, but the idea is that we also provide the service of monitoring all these parameters as well.”

Mining already represents 50% of Bosch Rexroth’s business in Peru. While Peru’s large fleets of mining machines will

continue to present significant opportunity for the company’s hydraulic drive business, it is in the processing plants that the company sees greater room for development in the automation area: “Mobile machines are closed systems. The plants, however, include many components from different brands. The feeders and conveyors, for example, are huge investments that use a big amount of drives, so there is an opportunity for us to come in,” concluded Rothgiesser.

COMMUNITION AND MATERIAL HANDLING

Companies involved in the technology for mineral handling and processing facilities are also gearing up towards the new wave of projects, as well as the service and maintenance contracts associated to an increasing installed capacity. Last year, for instance, 65% of Metso’s sales in the Pacific Rim region came from services. Equally, FLSmidth has increased its team for the Customer Service business line, which is not an easy process for OEMs, said Jesús Cabrera, general manager of FLSmidth: “Providing maintenance and repair services is more challenging because it requires a larger headcount to work on projects such as plant shutdowns. You need people who have certain skills and a safety culture.”

The advantage of having a stronger team of people is that this can also provide synergies to offer additional services. As an example, FLSmidth has been increas-

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ingly implementing the EPC concept, with five of these projects already completed in Peru, explained Cabrera: “At Antapaccay, we did the EPC for the expansion of their flotation capacity, with the largest flotation cells available worldwide. It was a very successful project.” Large OEMs are also starting to offer mining and material handling solutions that could forego the need for mining trucks. Thyssenkrupp Industrial Solutions, for instance, is looking at introducing continuous mining systems in the country. Miki Villar, business development and sales manager at Thyssenkrupp, explained that this technology is most suitable in mines that have distances of more than five km between the mine and the plant, and hauling volumes of at least 50,000 mt/d.

So far, Thyssenkrupp’s star product in Peru is the high pressure grinding roll (HPGR), of which there are 21 operating in Peru—that is more than in any other country where the company operates. Villar explained the advantage of this product versus other comminution solutions: “One of the key advantages of this particular technology is that it creates micro-crevices, and these make the grinding and crushing process more efficient, which adds to lower energy consumption.”



Peter Gnos,
general manager, Andritz

“We are migrating toward the sale of standard equipment, which is easier for both parties. It is very similar to what Caterpillar or Komatsu already do. Probably 20% of our sales today are standard equipment, and we are willing to increase that figure to 50% over the next couple of years. This, however, requires an important change of culture.”

For Villar of Thyssenkrupp, the shift towards standardization is driven by the bad experiences of projects during the boom: “Projects that started with a certain budget often ended up having huge cost overruns and significant project execution delays because of the excessive customization of the equipment. Standardized machines give the benefit of faster delivery times and lower-cost engineering.”

STANDARD VS TAILOR-MADE

In the mining industry, like in many other aspects of life, it is horses for courses. Some companies want to control the engineering of every single piece, while others are happy with the use of standard models that can be shipped, assembled and installed within a shorter time frame, providing for easier access to spare parts as well.

One of the main developments for Metso, one of the market’s large OEMs, has been a push to standardize its product line. Fernando Samanez, VP sales at Metso, explained the rationale behind this move:

WATER MANAGEMENT

The main technology companies are highly involved in solutions to increase water recovery, and they actually envision future mines that will have no tailings dams: “While many mining operators still see these solutions as being too expensive, the new regulations and the demands from the local communities will increasingly push companies to go in this direction,” assured Cabrera of FLSmidth.

Metso is also investing in new technologies to filter tailings, with a new prototype being developed in Sweden this year. “It is based on our current technology, but applying 10 times more pressure,” said Samanez, who added: “Water recovery is the future of mining.” Water separation is an increasingly important business for Andritz, a multinational company that has been expanding its installed capacity of thickeners, filters and water treatment plants in Peru. As an example, Andritz is installing the largest filter press ever built by the company globally (140 plates of 2.5 by 2.5 meters each) at Buenaventura’s Tambomayo mine.

Andritz is also reinforcing its service capability by opening up a local shop in Peru, avoiding import delays for products. “Peru’s mining industry only discovered the quality of our products relatively recently, so there is a lot of room for growth,” declared Peter Gnos, general manager of Andritz.

Everaldo Abegg, country manager for Andritz’ separation business, added: “We have recently invested US\$5 million in our filter cloth production line in Brazil, and with this investment we are ready to serve the whole South American market. We already have some thickeners in operation in Tambomayo, and also 14 water treatment machines in Cerro Verde. Overall, in the separation business, mining represents 85% of our revenue.” ■

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Mining Services

Price is still a big driver but the technical side of proposals is increasingly important



Blasting operators on site. Photo courtesy of Exsa

During the hard times, providers' margins were pushed to the limits. The price was among competing suppliers, desperate to keep their contracts, allowed mining companies to stay competitive, but the urge to save costs also created other problems related to quality and service. Fortunately enough, the industry is now producing minerals at a comfortable price range and increased profitability. While that should not translate into cost overruns, the relationship between miners and providers should be one of mutual benefit that looks at long-term sustainability for both parties.

EXPLORATION DRILLING

Exploration was probably the segment that suffered the most, because the level of activity was drastically reduced or, in some cases, stopped altogether. Jorge Granda, general manager of AK Drilling International, a contractor with a fleet of 25 machines in Peru and operations in seven countries, explained that the low volume of work available and high pressure on drilling rates made the downturn a difficult period to adapt to: "During the crisis, the procurement specialists within the mining companies were empowered to take many decisions about which contractors to use. Seeing the drilling service as a commodity means that you will only pay attention to the final price, and this is shooting yourself in the foot."

Geotec, another drilling contractor, has seen a positive trend in the market, and doubled its sales in 2017. Recent drilling

campaigns by the larger mining operators are prompting contractors to invest in automation and new technologies related to safety. Geotec's general manager, Miguel Ángel Arenas, said: "We increasingly saw clients ready to pay more for safety and new technology. In Las Bambas, we incor-

porated seven hands-free rod handlers, so the whole drilling campaign was hands-free. This year we won a contract to introduce intelligent machines for rod handling in underground mining. It is the first hands-free diamond drilling campaign for underground mining in Peru."

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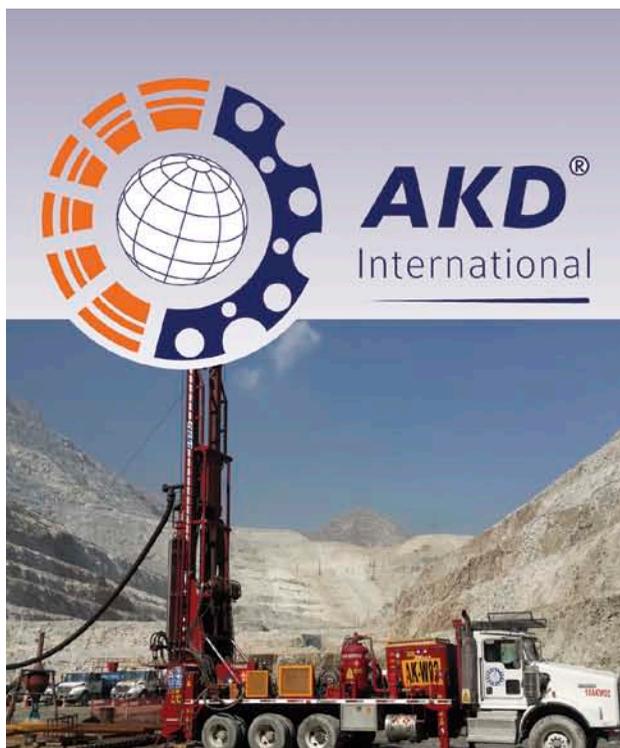
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Arenas highlighted that some mining companies are willing to engage in long-term drilling contracts, like the three-year assignment Geotec has at Yanacocha, because they know the drilling rates will increase very soon. Asked about the investment required to incorporate the hands-free rod handlers, he explained: "If you include the training required, a hands-free rod handler for a surface drilling rig can cost US\$450,000, while a brand-new drilling machine costs US\$600,000. Not all clients are willing to pay substantially more for their drilling, but for us this amount needs to be seen as a long-term investment where we are also improving productivity, efficiency, and safety." Granda of AK Drilling affirmed that the introduction of these new technologies, however, should not be seen as a 'one-size-fits-all': "At AK Drilling we were one of the first contractors to use these technologies for an oil and gas project in Colombia. In the oil and gas industry, you spend months on the platform and each pipe weighs half a tonne. In mining exploration, the rods weigh 35 kilograms, and you are on a platform for just a couple of weeks. In mining, you need an agile setup and competitive costs [...] At the end of the day, it is the end user who needs to decide what is best for each particular project."

LABORATORIES: PROCESS INTEGRATION

Laboratories in charge of geochemical analysis are having to expand their capacity to keep up with demand. Certimin, for instance, can now handle 1,500 samples per day, and is opening up a sample preparation facility in Cajamarca, which adds to the existing sites in Juliaca, Arequipa and Lima. The company has consolidated its focus on geo-metallurgical services, whereby it starts looking at the metallurgy from the first phases of exploration. Miguel Caillaux, director of Certimin, provided more details: "The geo-metallurgical approach requires the samples to be handled properly, so they can be used in both geochemical and metallurgical tests. At the end of the day, you need to decide on the best mineral composite to be sent to the plant. If you do not do the right job, you will send ores with high variability, causing the plant to obtain lower recovery rates. Over a long period of time, the impact of one percentage point in the recovery rate can be huge." Global company Bureau Veritas is also expanding its reach, with the opening last year of a new sample preparation facility in Arequipa. The company is a leader in the outsourcing service of

"With the geo-metallurgical approach, you use the samples for both geochemical and metallurgical tests. At the end of the day, you need to decide on the best mineral composite to be sent to the plant."



**Miguel Caillaux,
director, Certimin**

laboratories at the mine site, with seven such operations country-wide. Jameson Linares, director of Metals and Minerals at Bureau Veritas, affirmed that service providers have been increasing their value proposition so miners and explorers can focus on their core businesses: "We do not only provide the geochemical analysis, but we make sure that the sample follows the right procedure from the moment it leaves the drilling rig, with the right cutting, labelling, storage, as well as some initial parameters that can be used further down the value chain. This is very useful for juniors because juniors do not have a big team to take care of all these aspects."

NEW BLASTING TECHNOLOGIES

If 2017 could be seen as light at the end of the tunnel for exploration-related companies, the blasting market remained tight with the arrival of new competitors and a continued focus on cost reductions and productivity. For Exsa, one of Peru's main rock fragmentation companies, innovation was instrumental to assure the company its strong positioning in the open pit segment, where it has a 45% participation. Through the introduction of the Quantex technology, clients obtained cost reductions of 30% in the blasting process and 80% reductions in CO2 emissions, according to Gustavo Gómez Sánchez, the firm's general manager.



Jameson Linares, director of Metals and Minerals, Bureau Veritas



Gustavo Costa, general manager, Orica

Gómez Sánchez highlighted that the second half of 2017 allowed for an increase of work volumes but that the higher price of ammonium nitrate presented some challenges as well. Moving forward, Exsa will continue expanding its scope, offering specialized blasting services for construction and non-production activities, and leveraging its brand-new initiation systems plant in Peru: "This is the only new plant built in the region for more than 20 years, so the gulf in technology is vast. We will reduce our environmental footprint, as the plant will not use lead and is far more efficient. We are specializing in non-electric detonators, detonating cords, boosters, shock tubes, PETN and we are in the process of manufacturing end products as well," he said. Innovation is also a key pillar for global blasting players like Maxam and Orica. Orica participates in Peru's mining indus-

try through both blasting solutions and the provision of cyanide for gold mines. The company is introducing a wireless detonation system called Webgen that consists of a wireless primer and supporting equipment. Webgen is already being used in underground mines in Canada and Australia, and it should be tested in Peru this year. Gustavo Costa, general manager of Orica in Peru, provided more details: "As there is no need for wiring, Webgen allows our customer to have fewer people exposed to risks and for less time. Moreover, we are capable of significantly reducing the blasting time cycle [...] For example, in mines that usually have thunderstorms, the wireless process will allow work to carry on for longer and will reduce the stoppage time." Finally, Spanish-based multinational Maxam is targeting growth in Peru



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through its Rioflex hydrogel technology, already in operation in Chile's large open-pit mining segment. According to Maxam's general manager in Peru, José Luis Alonso, the Rioflex technology offers 25% more energy than equivalent emulsion blends through a wider range of available densities.

Asked about how much the final price weighs on mining companies' tenders for blasting solutions, Alonso said: "In Peru we see that our customers are requesting value added propositions to optimize the total cost of their operations beyond the cost of drill and blast. This holistic view is what has enabled us to be successful around the world, and we see the industry in Peru moving towards this more sophisticated and smarter approach."

CHEMICAL SUPPLIES

Following market trends, providers of chemicals are also moving away from the mere supply of products to offer higher-value solutions and consultancy support. Quimtia, a company with a footprint in the

wider region but whose mining practice is mostly focused in Peru, has seen specialties increasingly overshadowing the more traditional business of commodity trades, where the company provides copper sulfate, sodium cyanide and activated carbon. It was on the environmental front that Quimtia started its diversification: "Due to the numerous gold and silver mines that have to deal with cyanide contamination in discharge streams, there was a strong opportunity to implement related solutions in the Peruvian market," said Eduardo Galdo, sales manager of mining at Quimtia. "We started to treat this type of discharge, eliminating cyanide, removing other contaminations like extra metals, regulating the PH and reaching standards that the law required. These environmental solutions took our portfolio to another level."

Today, advanced oxidation technology, like the hydrogen peroxide used for cyanide destruction, contributes to 30% of Quimtia's business, while other niche products used to improve recoveries in both leaching and flotation processes already make up 20%



Eduardo Galdo,
mining sales manager, Quimtia

of revenue. Moving forward, these two segments (environmental care and metallurgical recoveries) should continue to grow for Quimtia. "We are working with Nalco to develop their WaterShed business in Peru. This technology increases water recovery while improving deposits and increasing the life of a tailings dam. We believe that it is now the perfect opportunity to implement it as tailing dams reach full capacity," said Galdo.

Ixom, a company created from the divestment of Orica's chemicals division in 2015, is also increasingly focusing on regular supply relationships for mining clients rather than spot commodity trades. The company's mining business grew by 30% last year, triggered by contracts in water treatment and flotation with large copper producers. Claudia Marchini, country manager of Ixom, declared: "Our chemicals business was mainly based on commodities, which allowed us to start relationships with large customers and increase our volumes in the past. After that, the fall of copper and other mineral prices represented an opportunity for us to offer specialty chemicals for mineral processing."

Ixom covers several business areas across the mining industry supply chain, including the developing of emulsifiers for explosives, and it has a plant in Chile where it produces flotation agents. Marchini gave more details about the importance of creating tailored products for the different mines: "We have specific products and applications to improve productivity in oxides or sulfides of copper, zinc, lead and precious metals. In copper concentration, we develop customized collectors according to each specific ore mineralogy," she concluded. ■

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**Adolfo Vera, president and CEO,
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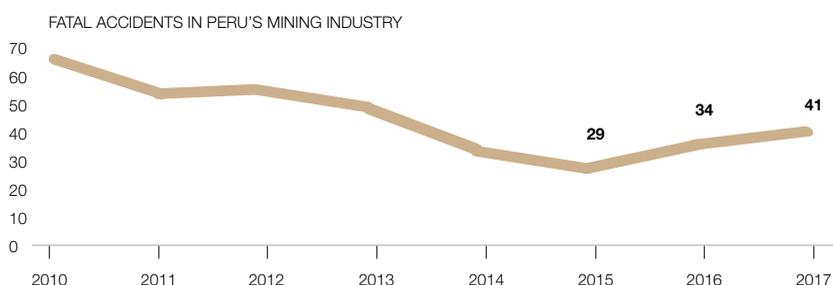
“Rock-fall related accidents may be caused by the wrong support solution, or by a bad mine design leading to rock burst. Besides, many workers fill all the safety forms because they have to, but then there is not enough supervision once the shift starts. There is a culture of overconfidence, where workers believe nothing will happen to them.”

**Frank Vásquez, sales manager,
New Concept Mining**



“The rate of production has increased and perhaps not all the safety measures have adapted to that. Besides, you have to fill out 5,000 forms, but that does not translate into a safer work environment. It is only recently that we have started seeing some mining companies looking at the implementation of the programs rather than the paperwork.”

**Marc Blattner, general manager,
Tumi Raise Boring**



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“This new cycle of global growth sees Peru in a great position to make the most of it”

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

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

As previous governor of Moquegua, what were the lessons learnt from the Quellaveco dialogue table?

This was a model for consensus building that needs to be replicated in other projects. If Quellaveco finally goes ahead, it is going to be a very important project for Peru's economy. There, a new challenge arises: the regional and local authorities need to be prepared to manage the tax money generated by the project. Those funds should not be used to build large monuments or white elephants, but to substantially improve the lives of all Moqueguans.

Do you think Peru should continue the decentralization process?

I am an advocate for decentralization. During this process, we have had good examples and bad examples. Those who defend a return to centralization only high-

light the bad examples. Decentralization has its challenges, but the solution is not to go back to centralism. We need to strengthen the regional structure, identifying and correcting the problems. Also, we need the population to be educated, empowered and vigilant, to ensure that their authorities use their resources properly.

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

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

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

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

Peru Mining 2018 - Special Pre-Release Edition

This publication is a pre-release edition of GBR's full special report on Peruvian mining, that will be published in Q3 2018. If you wish to be interviewed for the report, please contact Sofia Messina (sofia@gbreports.com)

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