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Photo courtesy of Southern Copper.

Peru's Mining Sector: Rethinking the Future

As the industry becomes more dynamic globally, new strategies are required to avoid fresh growing pains

With decent gold and silver prices and a very positive upward trend in base metal prices over the last months, miners worldwide seem to have started 2017 with more confidence in the near-term future. In Peru, leaders surveyed confirm that activity has been picking up and that operators, after a great deal of cost-cutting and efficiency-searching, are finally in a healthier position to make the investments in capital equipment, exploration and other fields that had been deferred for the last three years.

The down-cycle was a long, difficult journey. This experience should ensure that, while companies finally look for growth and new brownfield or greenfield projects, they

do not neglect to focus on maintaining low production costs. According to Víctor Gobitz, president of the Peruvian Institute of Mining Engineers (IIMP) and CEO of Buenaventura: “The mining industry is a price-taker. We cannot assign different attributes to what we produce to sell it at a higher price, like the automotive industry does, for instance.”

Following the same principle Luis Marchese, country manager of Anglo American and recently appointed president of the National Society for Mining, Petroleum and Energy (SNMPE), explained one of the main objectives of the main industry association: “We must improve the sector’s competitiveness, both in terms of the upcoming new genera-

tion of projects in front of other mining jurisdictions, and of the current operations, especially with the growth of copper production.” Hence the efforts by mining operators to keep a sustainable cost base and assure their margins. Peru is already one of the most competitive mining producers worldwide, as highlighted by the International Monetary Fund in a recent report. Reasonable labor costs and a favorable exchange rate during 2016 played their part, but managers locally also implemented a number of strategies to make the most of their existing operations. Luis Rivera, executive vice-president for Gold Fields in the Americas region, described how the company achieved significant savings at

their Cerro Corona gold-copper mine in Cajamarca during 2016. The measures implemented included the use of additives to diminish fuel consumption, a more productive blasting process, the implementation of the Dispatch system for more efficient haulage, the installation of a gravimetric circuit for higher gold recovery and an increased copper recovery rate through the use of better reagents. "In 2017, we are trying to improve our mine wall conditions at Cerro Corona to access deeper mineralization with higher grades. This, coupled with our better cost position, would allow us to expand our reserves and extend the mine life. Also, we have 7 million metric tons (mt) of oxides that are not included in our mining plan today. Before the end of the year we could have a feasibility study for a leaching process facility," said Rivera.

Such efforts are replicated across the underground segment as well. Hochschild Mining, a precious metals producer, currently has all-in sustaining costs of \$11.5 per ounce of silver equivalent, as compared to \$22 five years ago. Meanwhile Southern Peaks Mining has reduced the production cost at Condestable, a medium-sized copper operation, from \$42.9/mt processed in 2013 to \$25/mt today.

"The government has set a goal to attract \$14 billion in investment over the next five years. With the exception of Quellaveco, most projects are in the range below \$1 billion. It is going to be a challenge to promote this new generation of projects."

Luis Marchese, president, SNMPE



Adolfo Vera, president and CEO of Southern Peaks, explained that the company has always been comfortable hedging some of their production to minimize the risk of short-term market fluctuations, but emphasized that they have also introduced significant longer-term changes to the operation since they acquired the asset from Trafigura in 2013: "We have migrated towards massive methods that are less labor intensive. 70% of our production is achieved through sub-level stoping, as opposed to 30% before [...] A paradigm shift is to see Condestable as a poly-metallic mine and no longer as a copper mine. In the past, we have always focused on the copper head grade, but now we analyze the copper-equivalent grade," Vera said.

ADDRESSING THE SHORTAGE OF NEW PROJECTS

According to estimations from the Ministry of Energy and Mines and Peru's Central Reserve Bank, total mining investments fell by nearly half year-on-year, from \$7.5 billion in 2015 to less than \$4 billion in 2016. As Las Bambas and the expansion of Cerro Verde saw their completion, there are no new copper mega-projects on the horizon, at least not immediately. The \$1.2 billion expansion of Southern Copper's Toquepala operation is currently the largest project under implementation, but since social issues put a stop to emblematic projects such as Conga and Tía María, the general election and a fairly depressed copper outlook did not help the industry push for new ventures.



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To date, there are not many new investment announcements being made, yet winds of change can be felt. The election of Pedro Pablo Kuczynski last year, a business-friendly President, and the appointment of proactive officials within the Ministry of Energy and Mines, came hand in hand with the production constraints at Escondida in Chile and Grasberg in Indonesia, two of the largest copper mines worldwide, that accentuated the upward trend of the copper price earlier this year – providing a better picture for new project developers. Also, the fact that the SNMPE is chaired by the Anglo American representative is a sign that the company will sooner or later move ahead with the Quellaveco copper project, after years of back and forth, while other large players in the country like Southern also anticipate significant expenditures to expand the Cuajone operation as well as the Ilo smelter and refinery.

Luis Marchese, president of the SNMPE, hopes that industry investments will outperform the \$14 billion predicted by the government for its five-year mandate. “With the exception of Quellaveco, most projects are in the range below \$1 billion. It is going to be a challenge to promote this new generation of projects,” he said.

“We are trying to improve our mine wall conditions at Cerro Corona to access deeper mineralization with higher grades, and thus expand our reserves. Also, we have 7 million metric tons of oxides that are not included in our mining plan today. Before the end of the year we could have a feasibility study for a leaching process facility.”

Luis Rivera, executive VP Americas, Gold Fields



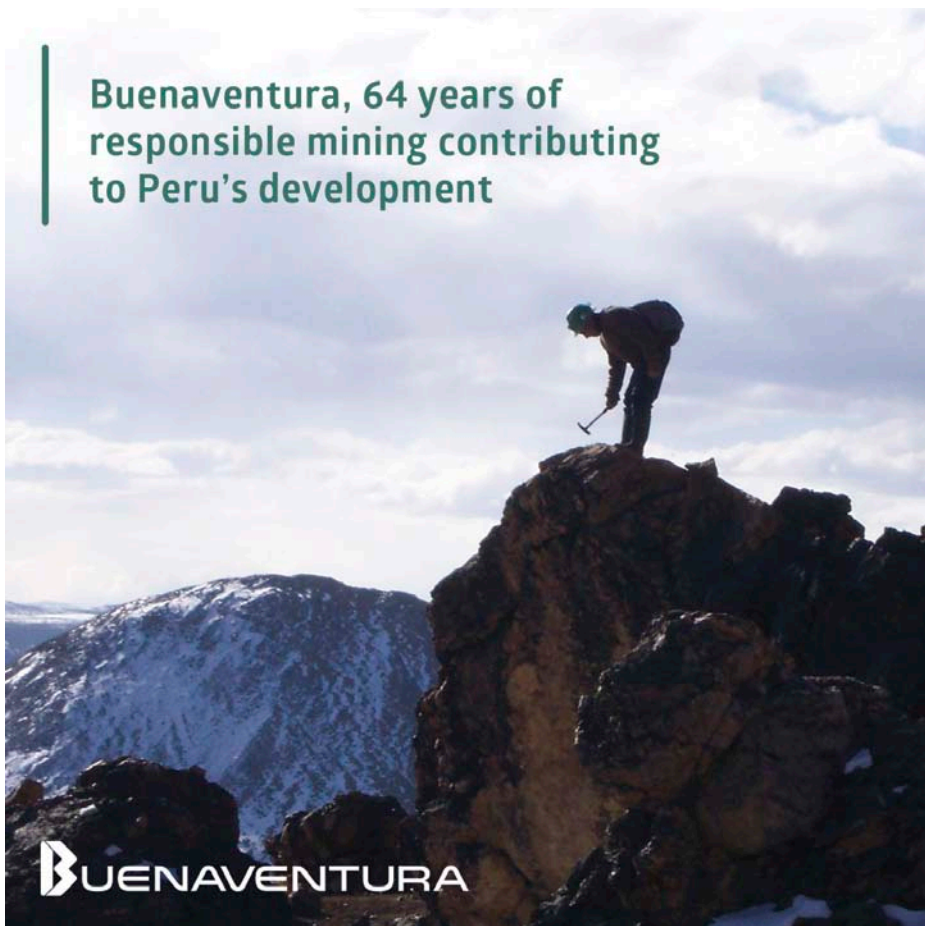
It seems clear that Peru will receive new green-field investments over the next years, but for that to happen, the authorities need to make sure all the conditions are met for investors to spend money in Peru rather than in other jurisdictions. Competition is tough and countries like Ecuador and Argentina are taking decisive steps towards developing their mining industries. Companies with assets in Peru, like Fortuna Silver and First Quantum, for instance, have already acquired assets in Argentina.

On the regulatory side, Peru is considered to be fairly competitive, and it has certainly proven to be a friendly investment destination

for the last quarter of a century, a track-record that Argentina, with tax retention on exports and currency exchange limitations only abolished recently, cannot match yet. If anything, with the development of the industry over the boom years, Peru has suffered from an over-regulation effort. Marchese of SNMPE referred to the fact that, over the last 10 to 12 years, the amount of permits required to move a project into production has quadrupled, from 50 to 200 today.

Some legal experts agree that it is time to rationalize the legal framework. José Miguel Morales, partner at García Sayán Abogados and member of the team that put together the Mining Law in the 1990s, commented: “While in 1993 we were able to create a law that allowed the large players to come to Peru, today the legal framework has become far too complicated. You need an army of lawyers and four or five years to move a project forward. We need to simplify permitting, the government needs to uphold the permits obtained, and overall an update is needed to have a regulation for the 21st century.”

Buenaventura, 64 years of responsible mining contributing to Peru’s development



BUENAVENTURA

COMMUNITY RELATIONS

Leaving aside regulatory matters, the social aspects are key, as shown by the fact that large mining projects have been derailed by unsolved disputes. Obtaining a social license has become an important risk factor that companies need to address from the beginning, and getting the go-ahead to build the mine and initiate production does not guarantee that the operation will not be halted later on. Las Bambas, one of the country’s largest copper mines, reached commercial production last year but has had to find alternative routes to take its concentrate to the port of Matarani as the locals have blocked the main road for months. Meanwhile, Hochschild Mining had to stop production at the Pallancata mine for more than a month due to another road blockade that ended in late January.

Ignacio Bustamante, CEO of Hochschild Mining, explained that the government played a proactive role in settling the dispute with the community, but he added: "Looking at the future, the government's role must be that of preventing conflicts. In this respect, the authorities need to better understand the sector and have more intelligence on the different actors around the mines."

Another aspect to be considered is the domino effect that a conflict in a particular operation can have over a neighboring mine or project. First Quantum Minerals, for instance, decided to postpone resettlement discussions with the communities in the Haquira project, a deposit hosting 6.5 million mt of copper, until the social context in the Apurimac region calms down a bit. Haquira would require around 1,000 people to resettle. Mike Parker, general manager for South American projects at First Quantum, explained the rationale behind this move: "Apurimac is undergoing profound changes with the influence of Las Bambas and nearby Constancia in Cusco to some extent. That still has to settle down. Dialogue tables have been created in an effort to allow the central government, Las Bambas, local authorities and communities to discuss how to implement pending development projects. That situation does not

"The Toquepala expansion is a \$1.25 billion investment to double milling capacity from 60,000 mt/d to 120,000 mt/d. It sounds unreal, but we have 41 mills operating for the current 60,000 mt/d –the plant has more than 50 years. The expansion should be ready by Q1 2018, with full production by Q2 2018. It consists of two large 30,000 mt/d mills."

Óscar González Rocha, president and CEO, Southern Copper



bode well for a project like ours to try to talk about resettlement."

The authorities should take these issues very seriously because not long ago First Quantum had a clear plan to build Haquira after Cobre Panama, while today the company is keeping its options open with the possibility of building Taca Taca in Argentina first. Taca Taca would require no community resettlement, even though longer-term political risk in Argentina also needs to be taken into consideration (Taca Taca is a 28-year project).

In any case, most leaders agree that the Peruvian government needs to extend its presence

across Peru's vast territory to reach the country's dispersed population with basic social services, otherwise the communities will demand mining companies address these needs. The model of the Mining Canon, whereby a percentage of the income tax paid by the mines goes to the regional and local governments, has proven ineffective, due to the inability of the different institutions to execute development projects in a timely manner. Earlier this year, the central government approved a decree to create the so-called Social Advancement Fund, which aims at investing in basic infrastructure for the local population in target areas where

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Peru's Minister of Energy and Mines



"Positive decisions this year should translate into higher investment levels from 2018 onwards."

What is the vision of the Kuczynski administration with regard to the development of mining activities?

This government understands that a significant driver of Peru's economic development is our geological potential. Peru is and will continue to be a mining country. In recent years we have become the second largest copper producer and we are among the top five producers of other metals. The conditions are there for us to maintain this leadership position, because we have only explored a small portion of the country.

Over the last years, mining has been impacted by a combination of external factors, with the end of the super cycle and the drop of commodity prices, and internal factors, with an increase of what we call 'transaction costs' related to advancing projects to the operational stage. This has to do with the de-centralization of decision-making in many government agencies, with red tape and, in some cases, with social conflicts. We are introducing mechanisms to make the rules simpler and to expedite procedures at the exploration stage. In environmental matters, we are introducing a single window and electronic processes. Finally, with regard to social conflicts, the previous government left a wide perception that it failed to fulfill the commitments it had with the communities. We want to rebuild trust with a more coordinated State presence in the affected areas.

"We are introducing mechanisms to make the rules simpler and to expedite procedures at the exploration stage. In environmental matters, we are implementing a single window and electronic processes."

How is this government going to channel the investment into social development projects?

There are two mechanisms. On one hand, the Ministry of Finance is issuing sovereign bonds to fund infrastructure projects. The first of these offerings has already been completed to finance projects in Cajamarca. On the other hand, in January the government created the Social Advancement Fund that articulates the activities of several ministries to work together and address the needs of these regions with diverse sources of funding, from government resources to donations from multilateral bodies or companies.

Peru has had mixed results in terms of the development of basic infrastructure. How can this record improve?

In the main mining regions you can see an improvement of the socio-economic levels. Probably, in those areas where there has been a bigger involvement of private parties, the projects have obtained better results, either through the Works for Taxes pro-

gram or the Voluntary Contribution program. In those projects that were handled by the State, we have seen the country's weaknesses, with delays in the execution and the development of projects that do not solve the people's most basic needs, such as stadiums or bullrings, instead of systems for drinking water and sanitation. It is a complex problem of a sociological and anthropological nature.

Mining investment in Peru has fallen consistently since its peak in 2013. When do you expect this trend to be reversed?

In recent years, we have seen the completion of world-class projects, such as Las Bambas, Toromocho and the Cerro Verde expansion. It is absolutely normal that expenditure levels decrease after projects of that size. That being said, metal prices are improving and we expect companies to take positive decisions this year with regard to new projects, like Pampa de Pongo, Corani and Mina Justa, which should translate into higher investment levels from 2018 onwards. We also expect a decision on Quellaveco mid-2018.

What is your position about Southern Copper's Tía María copper project?

In the same way that this new government is changing its approach towards community relations, we have told the owner of Tía María that they also need to change their strategy to promote the project. If they do exactly the same things as before, that change is not going to happen. The company has appointed a new manager to develop the project, and we expect some progress if they manage to improve their relationships within their areas of influence.

What can be done to solve the problem of illegal mining in Madre de Dios, and what has this administration changed with regard to the formalization process of the previous government?

The environmental problem in Madre de Dios is very serious, and our position is very clear to be against the development of alluvial mining. Having said this, the new formalization process looks at addressing some of the limitations of the previous process, which had very poor results. We have tried to improve the economic incentives to encourage formalization, to strengthen the relationship with the regional governments, and to create a mining fund to promote the production of clean gold in Peru.

big investment projects are expected to take place. While this shows the Kuczynski's government good intentions, how this fund will actually be deployed is unclear for the moment.

To build trust, mining companies also need to play their part, abandoning their classic low profile and explaining to the wider population how the mining industry works. In the words of Víctor Gobitz, president of IIMP: "The mining sector is perceived as distant because it is an activity that takes place mostly in the high Andes, where human development indexes are very different to those in the cities. This generates high expectations that are difficult to manage".

From the mining companies' perspective, it is very important to pay attention to all stakeholders, says Óscar Díaz, CEO of Viceversa Consulting: "If problems were solved with money there would be no conflicts, because the mining industry is very rich. You need empathy to connect with the needs of the people and to have an integrated approach towards risk. If you deal with some communities but neglect some others, you will have problems. If you strengthen relationships with the regional governor but do not pay attention to the mayors, you will have problems. If you focus your efforts on the Ministry but forget the municipalities, you will have problems."

A FRESH LOOK AT PROJECT DEVELOPMENT

Over the last years, the various Peruvian governments have boasted of the country's extensive mining project portfolio to attract investors worldwide. Even with some unfortunate exceptions where projects were stopped, official figures show that the industry invested \$53.5 billion in Peru between 2006 and 2015. According to the Ministry of Energy and Mines, the portfolio of future mining projects now stands at \$47 billion, a third of which already have their environmental impact assessment approved.

Some of these projects have been in the pipeline for far too long. While the Southern belt has developed tremendously over the last years, the large copper and gold projects in the north are not seeing much movement. After Conga was suspended, the copper price went down and the project became economically unviable. Meanwhile, anti-mining sentiment in the region of Cajamarca remains high, as shown by the results of the general election last year.

For both economic and social reasons, industry leaders are asking for a fresh, cooperative approach to mining development. For any project, building all the required infrastructure can become too costly now that metal prices are not expected to go back to the boom levels of

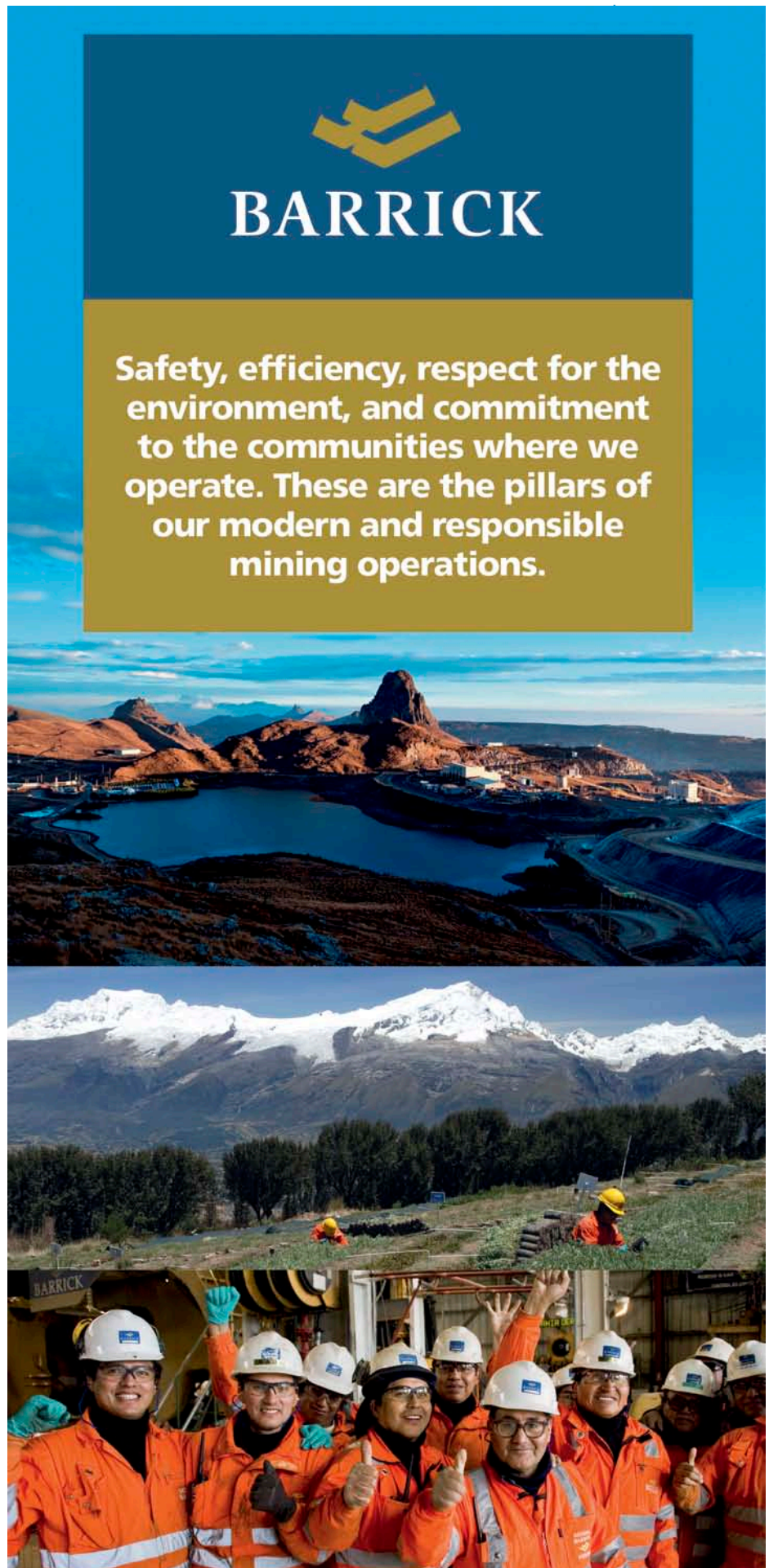




Photo courtesy of Pan American Silver.

"Yanacocha should take the Quecher Main project to feasibility this year. This initiative would extend oxide production into 2025, with annual output of no less than 200,000 oz/y Au. It is an open pit project within the existing footprint, which would also provide enough time to explore the Yanacocha sulphides project comprehensively."



Víctor Gobitz, CEO, Buenaventura

2011. Then, from an environmental and social perspective, reducing the footprint of these mega-projects seems a necessary step to obtain the social license in regions where mining is a hot potato of political debate. In the words of Luis Rivera of Gold Fields: "Mega-projects will need to capture some synergies that will translate into shared railways, shared tailings dams, shared pipelines and shared roads. Only this way can both the footprint and the costs that currently make projects unfeasible be reduced."

Víctor Gobitz of IIMP and Buenaventura agreed: "In Chile there is already an example of this type of collaboration, with Goldcorp and Teck. In the

case of Peru, Quellaveco sits in a region with existing infrastructure. Similarly, you could have different players working together in Cajamarca's copper area, where you have Michiquillay, Conga, Galeno and even La Granja [...] With all these projects put together, Cajamarca could produce over 1 million mt/y of copper."

The plan seems ambitious but reasonable, and would be better implemented if the government acted as a catalyst for industry efforts, designing and implementing a macro, long-term plan for the development of the country and its mining industry. Peru is already one of the largest mining countries worldwide, but there is enormous potential left. ■

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Production

Copper production broke the 2 million mt/y barrier during 2016

It was another great year for Peru's copper production. With the completion of Cerro Verde's expansion, operated by Freeport McMoRan, and the start of commercial production at Las Bambas by MMG, total copper output reached 2.35 million metric tons (mt) during 2016, a 38% increase year-on-year and a 70% increase over 2014 figures. Thus Peru reinforces its position as the world's second largest producer of the red metal after Chile, while Chinese copper output only grew by 11%, for a total of 1.85 million mt/y.

Company-wise, and according to data by the Ministry of Energy and Mines, Cerro Verde became the largest contributor with 522,100 mt/y (+104%), followed by Antamina with 443,600 mt/y (+8%), Las Bambas with 329,400 mt/y and Southern Copper with 312,900 mt/y (-3%) between the Toquepala and Cuajone operations.

Southern Copper is actually expanding Toquepala through a \$1.25 billion investment, to double milling capacity to 120,000 mt/d and thus add an extra 100,000 mt/y of copper production starting next year. Óscar González Rocha, president of Southern Copper, highlighted the fact that the expansion will be completed with the installation of just two large 30,000 mt/d mills. "It does sound unreal, but the existing capacity of 60,000 mt/d consists of a total of 41 mills. This is an operation that has more than 50 years."

After this, Southern will embark on the expansion of the smelter and refinery located in Ilo. The smelter will increase its processing capacity from 1.2 million mt/y to 1.8 million mt/y, while the refinery will go from 280,000 mt/y to 320,000 mt/y of cathodes. "The remaining production will be sold as anodes from the smelter. Once we finish the Toquepala expansion, we will decide if we expand the smelter first or if we go with the two projects in parallel. In total, we are talking of an investment of \$800 million to \$1 billion," said González Rocha, a figure that could become \$2.6 billion if the company also goes ahead with the \$500 million

"Over the last four years we have implemented an extensive mechanization program. Conventional wisdom suggests that mechanization leads to a significant increase in mining dilution, but we had less mining dilution than we had anticipated. I attribute much of that to the extensive survey and blast pattern controls we put in place for our mechanization techniques."



Steve Busby, COO, Pan American Silver

expansion projected at Cuajone to reach 120,000 mt/d of throughput capacity, and if the controversial Tía María project also sees the light at some point.

Southern is also reportedly interested in buying a stake in Anglo American's Quellaveco project due to the location of this deposit in between Toquepala and Cuajone. Luis Marchese, country manager of Anglo American, admitted that the company could incorporate a partner for the project: "It is unclear at this point if we will maintain our participation or if a new partner will join in. We need to revise the capex –we hope to lower the total amount to adapt the costs to the current market. The mine will process 127,500 mt/d, and the crystal ball says we should evaluate a construction decision mid-2018. Having said this, this schedule may change depending on market conditions," Marchese said.

Market conditions for copper are actually good, as proven by the fact that El Brocal, a versatile poly-metallic operation, is switching its focus towards copper this year, even if the mine produces arsenical copper. Gonzalo Eyzaguirre, general manager of El Brocal, gave more details: "The complex copper concentrate is not so much penalized these days, so we have launched an ambitious project to go from 7,500 mt/d to 13,000 mt/d of mining in the underground section to be completed in just nine months. The project includes the construction of the Esperanza tunnel, a tertiary crusher and improvements to the flotation process." Eyzaguirre said that the project encompasses \$14 million in direct investment on top of \$8 million in expenditures that have been moved forward in areas such as ventilation. El Brocal is a Buenaventura subsidiary, which helps generate synergies: "Perhaps the most successful [synergy] can be found in the commercial side of things, since Buenaventura now handles the sale of concentrates in a centralized manner. This gives us a better negotiating position," Eyzaguirre concluded.

ZINC AND LEAD

Besides copper, El Brocal is also a medium-sized producer of zinc, a metal where Peru is a prominent producer worldwide. While zinc operators took advantage of improved metal prices in the later part of last year, overall production in Peru went down by 6% to 1.34 million mt/y.

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This was caused primarily by a 12% decrease in Antamina’s zinc output to 261,500 mt/y, which placed Volcan, who also suffered a 4% reduction, as the country’s largest zinc producer with approximately 273,400 mt/y. Antamina, however, expects to boost zinc output this year to reach more than 340,000 mt/y. The other large zinc player in the country is Milpo, part of Votorantim of Brazil, that reported production of 258,700 mt in 2016. In other base metals, lead production remained flat at 314,100 mt/y, tin production decreased to 18,800 mt/y (-4%), and molybdenum output grew by 28% to just under 25,800 mt/y, helped by Cerro Verde and Antamina, which trebled and doubled their production figures, respectively.

“Thanks to a digitalization initiative under our ‘best-in-class’ program, we achieved efficiency improvements in our carbon-in-column (CIC) plant, and this allowed for savings of \$18.6 million last year alone. On top of that, this improved the recovery from the inventory at the leach pads, generating additional income for \$5 million.”



Manuel Fumagalli, executive director, Barrick



Photo courtesy of Barrick.

GOLD

Yanacocha's decline continued during 2016, with gold output reaching 668,200 ounces per year (oz/y) (-27%). Meanwhile, Barrick also saw production fall at the Lagunas Norte mine, from 560,000 oz/y in 2015 to 435,000 oz/y in 2016 due to the transitioning of the ore body into the sulphide section, yet margins remained extremely attractive with all-in sustaining costs of \$529/oz.

Manuel Fumagalli, executive director of Barrick, underlined some of the cost-cutting initiatives to keep the operation's profitability: "Thanks to a digitalization initiative under our 'best-in-class' program, we achieved efficiency improvements in our carbon-in-column (CIC) plant, and this allowed for savings of \$18.6 million last year alone. On top of that, this improved the recovery from the inventory at the leach pads, generating additional income for \$5 million."

The future of Lagunas Norte lies with the sulphide potential of the deposit and the refractory ore project, although the company is looking at ways to extending the mine life while delaying the investment on an autoclave plant. According to Fumagalli, they could develop a transition project to process the inventories: "Through screening, we can recover the oxides and leach them at the



Marcelo Santillana, general manager, Poderosa

leach pad, while the remaining carbonaceous material, which also contains oxides, could be processed via milling and a carbon-in-leach (CIL) plant. This way we can achieve an optimal sequence for the mine-life, because we move oxide production forward and we defer the capex required for the flotation and the autoclave process to treat the sulphides." In spite of the decline at the country's largest operations, Peru's total gold production grew by 4% in 2016 for a total 4.92 million oz/y. Some of the companies that contributed to this growth were Hochschild Mining, with the production from its largest operation, the Inmaculada gold-silver mine; and Minera Poderosa, that yielded 221,000 oz/y in 2016, a 12% increase year-on-year.

Marcelo Santillana, general manager of Poderosa, summarized the company's recent developments: "In 2016 we met our growth targets. We obtained the permit to implement technological improvements and process 800 mt/d at our Marañón plant, and we began the studies to expand our Santa María plant to 1,000 mt/d. For this project, we will have to acquire additional equipment, including two larger mills and a 1,000 mt/d crusher, however the largest expenditure will be the tailings dam at a cost of \$10 million."

Poderosa currently has 8 million oz of reserves, which would extend the operation's life to nearly 40 years at current production rates, however the company plans to invest \$40 million in exploration during 2017. Additionally, Poderosa is currently building a transmission line to assure the power supply for its expanded operation, which will use an additional 2 MW of capacity.

Recent highlights in terms of precious metals operations also include Tahoe Resources' Shahuindo, which started commercial production in 2016, and the inauguration of

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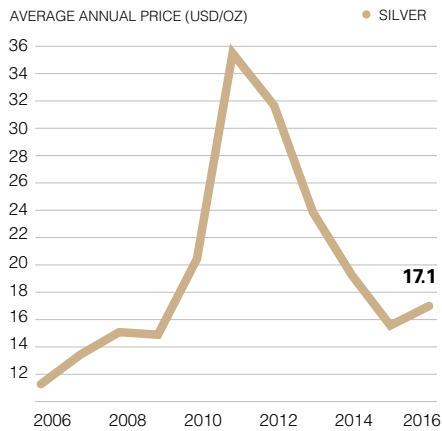
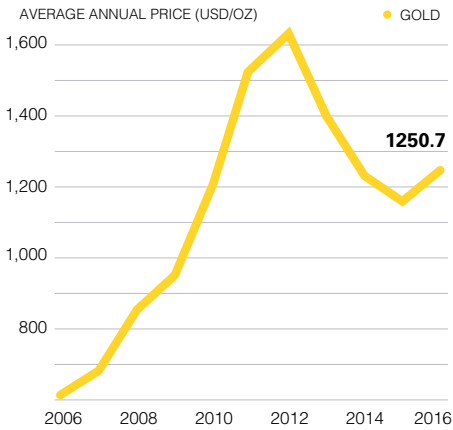
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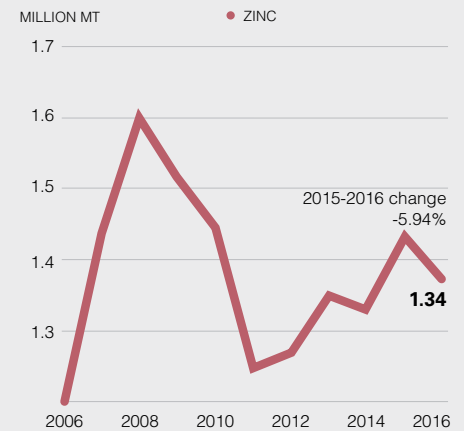
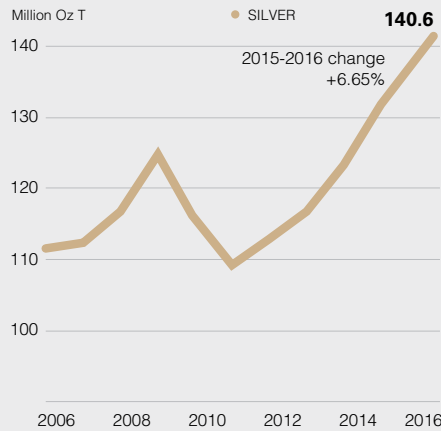
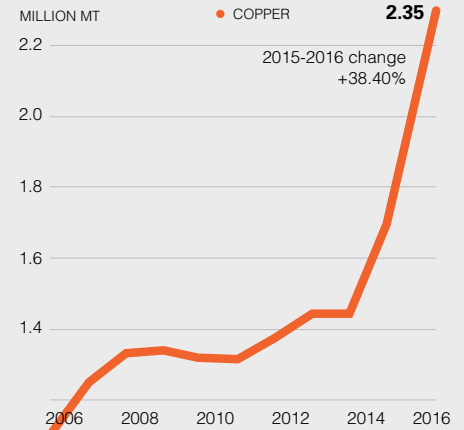
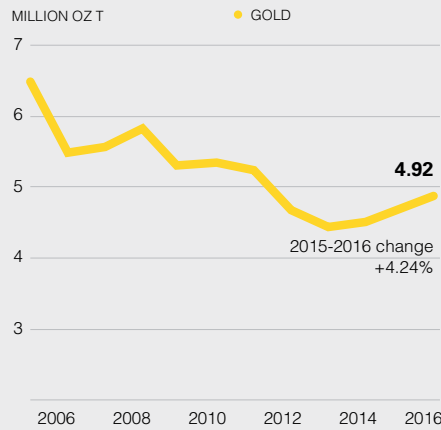
GOLD AND SILVER PRICE CHARTS

Sources: KITCO / GBR



PERU, A DIVERSIFIED METALS PRODUCER

Source: Ministry Of Energy And Mines / GBR



ZINC PRICE (MONTHLY AVERAGE)

Average official LME price, Cash Buyer

Sources: LME / GBR

Year	Month	\$/MT	\$/LB	
2016	April	1,851	0.84	
	May	1,871	0.85	
	June	2,022	0.92	
	July	2,184	0.99	
	August	2,282	1.04	
	September	2,292	1.04	
	October	2,314	1.05	
	November	2,568	1.16	
	December	2,671	1.21	
	2017	January	2,712	1.23
		February	2,847	1.29
		March	2,780	1.26

COPPER PRICE (MONTHLY AVERAGE)

Average official LME price, Cash Buyer

Sources: LME / GBR

Year	Month	\$/MT	\$/LB	
2016	April	4,850	2.20	
	May	4,707	2.14	
	June	4,630	2.10	
	July	4,855	2.20	
	August	4,757	2.16	
	September	4,706	2.13	
	October	4,731	2.15	
	November	5,442	2.47	
	December	5,665	2.57	
	2017	January	5,736	2.60
		February	5,940	2.69
		March	5,820	2.64

Buenaventura's Tambomayo mine, located in Caylloma (Arequipa) at 4,800 meters above sea level. Víctor Gobitz, CEO of Buenaventura, gave more details about the latter: "Tambomayo, developed in record time since 2009, has overcome a tremendous logistical and technical challenge and will yield 150,000 oz/y of gold and 3 million oz/y of silver. It is an underground mine that optimizes metallurgical recovery and uses filtered tailings disposal to assure the industry's best practices," he said.

In regards to Tahoe's expansion project at Shahuindo from 12,000 mt/d to 36,000 mt/d, Phil Dalke, vice-president and managing director for Tahoe in Peru, said: "Through some trade-off studies we established that ore treatment can be a better return on investment, so the Shahuindo project includes many things: the crushing and agglomeration circuit for ore treatment, a major leach pad construction, additional power and water and additional metallurgical tests to prove everything up."

At today's prices, Shahuindo has a mine life until 2026, and this operation will eventually replace the ounces from La Arena, the other Peruvian gold mine of the corporation. La Arena, however, is not over yet. It will continue producing 150,000 oz/y into 2020 and

"Through some trade-off studies, we have established that ore treatment can be a better return on investment at Shahuindo. It is a major expansion project to triple the current 12,000 mt/d operation by H2 2018, that includes the crushing and agglomeration circuit for ore treatment, a major leach pad construction, more power and water and additional metallurgical tests. At today's prices, Shahuindo has a mine life until 2026."



Phil Dalke, VP and managing director Peru, Tahoe Resources

there are plans for a large sulphide development. Tahoe's vice president for exploration, Brian Brodsky, provided the latest about this project: "In 2014, Rio Alto completed a feasibility study for a small operation, which included a resource of 275 million mt of mainly copper with gold credits. In 2015, we drilled some holes to prove that this body is open at depth and we have recently completed a scoping study that suggests a significantly larger project. We are currently undertaking a more detailed pre-feasibility study which should be completed later this year."

SILVER

In parallel to gold's good performance, Peru's silver production also increased last year by nearly 7%, reaching 140.6 million oz/y, with Buenaventura (24.7 million oz/y) Volcan (22 million oz/y) Antamina (20.9 million oz/y) and Hochschild (13.9 million oz/y) as the main producers.

Ignacio Bustamante, CEO of Hochschild Mining, affirmed that the company has plenty of space to maximize its existing operations in the country: "At Arcata we are using 1,700 mt/d of the 2,500 mt/d plant capacity, while at Pal-

A large advertisement for Atlas Copco. On the left, a worker in a white hard hat and a high-visibility vest with "Atlas Copco" on the back is seen from behind, looking towards a yellow piece of machinery. On the right, a white text box contains the following text:

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lancata we currently have 2,000 mt/d of excess capacity, although that will go down to 400 mt/d or 500 mt/d once we put the Pablo vein into operation. Besides, the Ares plant is completely idle and at Inmaculada we are going to accelerate our exploration work with the view of possibly expanding the plant, currently working at 3,850 mt/d, within the next two years.”

Meanwhile, Pan American Silver significantly improved its operating results in Peru thanks to an extensive mechanization program. Between Huarón and Morococha, the company produced more than 5 million oz of silver at very competitive cash costs, also favored by the strong U.S. dollar. Steve Busby, COO of Pan American Silver, commented on the productivity enhancement brought in by mechanization: “We were particularly concerned about dilution, but looking back at the last three years, we had less mining dilution than we had anticipated. I attribute much of that to the extensive survey and blast pattern controls we put in place. It has been a double win for us.”

Busby said that these improvements completely change the picture for the company’s Peruvian mines, old assets with a history of more than a century: “There is potential for expansion, both laterally and at depth. The difficulty for exploration is access, because we are deep underground and far from the entry point of the mines. This year we increased our exploration budget about 45% for the company, to around \$21 million during 2017. A lot of that is going to be focused at Huarón and Morococha, as well as La Colorada in Mexico.” The improved market conditions are also attracting new players to Peru. Great Panther Silver, a producer with assets in Mexico, recently signed a deal with Nyrstar to acquire the Coricancha mine in Peru, primarily a precious metals deposit with a base metals component, that had been in care and maintenance for some time. Once the final deal is closed, the company expects to conduct a preliminary economic assessment this year, and to invest between \$20 million and \$25 million to put the mine back into production. Robert Archer, president & CEO of Great Panther, said: “One of the things that struck me in Peru is that there are not many medium-sized projects owned and operated by public companies. I saw a lot of opportunity for public companies of our size with access to the capital markets to bring some of these mines into production. We want Coricancha to be our first base of operations, and then gradually grow in the country in the same way we have done in Mexico.” ■

Commodity Price Projections

Industry executives share their forecasts

"Copper demand will remain high. There are mines reaching the end of their lives and mines that are becoming uneconomic due to depth or grade constraints. We will need to replace copper production."



Mike Parker, general manager projects South America, First Quantum Minerals

"The tipping point into a deficit market in copper supply may have moved from 2020 to 2017. Since electric and hybrid vehicles use two to four times more copper than conventional vehicles, 25% of the worldwide supply for copper will be used just for electric cars in the future."



Luquman Shaheen, president and CEO, Panoro Minerals

"Annual uranium demand is 170 million lbs, while mine supply is 150 million lbs and is going down to 135 million lbs. Nobody can make money at current prices, but the spot price is relatively insignificant because almost everything is contracted at prices closer to \$40/lb."



Ted O'Connor, CEO, Plateau Uranium

"If the U.S. economy and the dollar give strong signals and interest rates rise, it should be a bad year for gold and silver, but if we see negative news about the U.S. economy or the political situation in the country, or if there are serious geopolitical conflicts, gold and silver prices will go up. Our conservative projection for this year is \$1,150/oz Au and \$16/oz Ag, but I think we will be at higher levels than that."



Ignacio Bustamante, CEO, Hochschild Mining

"Zinc fundamentals remain strong. The zinc price had not been more than US\$1.20/lb since 2008, so it has been at near 10-year highs in 2017. We believe that the timing is right for a company like Tinka to succeed in a strong zinc market with a strong upcoming project in a world class zinc belt."



Graham Carman, president and CEO, Tinka Resources



Project Development: Picking Up

After years of very low market conditions, it is refreshing to see project developers and junior explorers coming back to life

Two main trends have appeared in the market in recent years. On one side, you have those juniors who have learnt to navigate the low cycle through innovative business models, mostly aiming at generating cash-flow. On the other, the few juniors left with good assets and access to finance have benefited from much better market conditions to keep advancing their projects. This is an overview of the main companies active across the different niches of the business in Peru.

GOLD PROCESSING

Cash-flow generating models go from developing small mining operations with the support of contractors and third party mills, like Lupaka Gold and PPX Mining are doing, to the capital participation in toll processing busi-

nesses, following the successful model of Dynacor. Inca One Gold Corp and more recently Montan Mining and Duran Ventures have been investing in the development of mineral processing facilities in Peru.

Last year, Dynacor completed the construction of its new, 300 mt/d mill in Chala, Peru. The company processed third-party ores for a production of 73,500 oz/y last year, and expects to reach between 88,000 to 92,000 oz/y in 2017. "Our mill is built to the specified ore in the Peruvian mines in order to maximize the recovery rate. Over the years we have built up our knowledge and learned how to process the ore efficiently, blending the material in the best possible way to improve our production results," said Jean Martineau, president and CEO of Dynacor. Martineau explained that

Dyancor's model involved financing the company's exploration with the profit from the gold processing, thereby avoiding dilution to its shareholders.

Inca One Gold has also invested in a gold processing business in Peru, although in this case the company does no exploration. After a rocky start with delays to obtain the local tax rebates the company was entitled to, Inca One is finally on track to process 100 mt/d at their Chala One plant in Arequipa: "We are processing high grade gold ore with more than 20 g/mt, so it does not take a lot of tonnage to have significant cash-flow. This year our revenues will be between \$20 million and \$30 million. The expectation is that we will be able to process 30,000 to 35,000 mt/y over the May 2017-April 2018 fiscal period," said Ed Kelly, CEO of Inca One Gold.



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Kelly described the new formalization process for artisanal miners as “the most exciting piece to the business right now.” Although the impact of this new process remains to be seen (previous efforts were highly ineffective), Kelly says there is a pool of more than 15,000 informal miners that could become formal suppliers: “Funnily enough, gold exports in Bolivia and Chile have increased over the last few years, even if no new licenses have been granted in those countries. Obviously, that gold is actually being produced in Peru’s black market. Once these miners are formalized, we will be able to buy ore from them,” emphasized Kelly.

GOLD PROJECT DEVELOPMENT

With gold prices at stable levels and with Peru’s very competitive cost position in gold production, the market is hungry for new deposits. The prolific north-central mineralized belt is one of the main areas of interest according to the amount of mining concessions granted there over the last year.

Thomas Larsen, chairman and CEO of Eoro Resources, who are drilling the La Victoria property in Ancash this year, gave more details about these developments: “We now control 80 square km, adjoining Newmont to the south, which recently acquired a major land position. Also Barrick, Anglo American and Fresnillo staked ground in the nearby areas. Last July, First Quantum had also acquired a big land position to our eastern border, so there is a large audience in the area at this point.”

Eoro has recently signed an agreement with an Australian company, Cott Oil and Gas, that is funding expenditures for C\$2 million to earn a 10% interest in the project and have the option to spend an additional C\$3 million to obtain a 25% stake. La Victoria, located in Ancash, in-

“We are permitted for 8,000 meters at La Victoria and the drilling campaign should take us through mid-2018. In parallel to this, we are doing a lot of preliminary geophysics and sampling on the Ccori Orcco concession to prove the continuity of the mineralized system from 4,200 meters at San Markito to 3,000 meters at Rufina, and potentially deeper. We will also be doing fieldwork south of Rufina, towards the Newmont concessions.”



Thomas Larsen, chairman and CEO, Eoro Resources

cludes an epithermal gold system running 1.2 km vertically that Jim Steel, Eoro’s senior corporate advisor, considers to have the same geological setting as Shahuindo.

“We are permitted for 8,000 meters and the drilling campaign should take us through mid-2018,” continued Larsen. “In parallel to this, we are doing a lot of preliminary geophysics and sampling on the Ccori Orcco concession to prove the continuity of the mineralized system from 4,200 meters at San Markito to 3,000 meters at Rufina, and potentially deeper.



Photo courtesy of Geotec.



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We will also be doing fieldwork south of Rufina, towards the Newmont concessions. It is going to be a very active period for Eloro over the next 16 months," said Larsen.

Meanwhile, Lupaka Gold is advancing towards production at the Invicta property. The company suffered delays to sign the access agreements with the local communities, and was further delayed earlier this year with the Coastal Niño floods in the area, but financing is in place –\$6.1 million provided by Pandion Mine Finance in a gold prepayment agreement. The plan is to ramp up production using mining contractors this year.

"At 350 mt/d we have enough resources to be in production for around 10 years," said Gordon Ellis, chairman and CEO of Lupaka Gold. "Maybe we could acquire an existing plant, or it may make more sense for us to build a plant up on site. There are half a dozen plants within a reasonable trucking distance that are quite willing and competing to process our ore," he added.

On top of Invicta, which will be the key project to generate cash-flow, Lupaka has a joint venture with Hochschild for exploration at the Josnitoro copper property. Through geophysics they want to define targets to start drilling. Lupaka also owns Crucero, a project with an in-pit resource of 2.1 million oz of gold where Lupaka would like a buyer or a joint venture partner to take over.

THE COPPER FEVER

As Peru continues to enhance its profile as the second largest copper producer, a number of juniors with good financial backing are trying to define the next saleable copper deposit. Investors remember very well the successful run of different copper juniors in Peru, such as the transactions involving Norsemont (acquired by Hudbay Minerals), Peru Copper (acquired by Chinalco) and Antares Minerals (acquired by First Quantum), among others.

John Black, who led the Antares transaction in 2010, is now the CEO of Regulus Resources, a company focusing on its AntaKori copper project in northern Peru. AntaKori is located next to the Tantauatay gold-silver mine operated by Coimolache, a joint venture between Southern Copper and Buenaventura. Regulus has recently signed an exploration agreement with Coimolache to collaboratively share information and better understand the potential of the district. "Coimolache have basically bumped up against our land package," declared John Black.

AntaKori already has a copper-gold-silver resource of 295 million mt at a copper equiva-



John Black, CEO, Regulus Resources

lent grade of 0.8%, which the company expects to expand this year through a 15,000 to 18,000 meter drilling campaign.

Black gave more details about the geology of the project: "Previous drilling campaigns at AntaKori found extensive skarn mineralization that remains open in most directions and is similar to other occurrences in Peru, most notably Las Bambas and Antamina. At AntaKori, the skarn mineralization is cut by breccia bodies with fragments of porphyry copper-gold mineralization, indicating probably porphyry mineralization at depth [...] [Gold Fields] Cerro Corona, located 6 km from us, is a porphyry deposit currently in production."

The other big region for copper exploration is southern Peru, home to the majority of the large copper mines already in production. The area includes companies that have been known for a few years, including Panoro Minerals, as well as emerging new stories from juniors such as Kaizen Discovery and Pembroke Copper.

Panoro Minerals has PEA studies completed at both Cotabambas and Antilla, although the company is focusing its efforts on Cotabambas right now. Panoro counts Hudbay Minerals as a shareholder, and has a funding agreement with Silver Wheaton to cover expenditures until December 2018.

Luqman Shaheen, president and CEO of Panoro, summarized the main goals for 2017 at Cotabambas: "The first one is to drill 4,000 meters on the oxide mineralization north of the proposed pit. The second one is to drill the María José high-grade sulphide target – we plan to drill about 10,000 meters there, with a budget of \$3 million. The third priority is to carry out metallurgical testing to improve the recovery rates in some of the high gold oxides and also in the transition zone material."

Shaheen showed its confidence in the current copper fundamentals due to an upcoming copper supply deficit: "The tipping point into a deficit market in copper supply may have moved from 2020 to 2017. Since electric and hybrid vehicles use two to four times more copper than conventional vehicles, 25% of the worldwide supply for copper will be used just for electric cars in the future."

Kaizen Discovery, a listed company backed by HPX, has recently redefined its strategy to put its British Columbia exploration aside and work on copper-gold deposits in Latin America. Their current focus is Pinaya, an advanced project that was under the radar for the last couple of years due to litigation between the previous owners.

Now, Kaizen owns 90% of the project, in partnership with ITOCHU of JAPAN who hold the remaining 10%. Pinaya already has a resource of 41.7 million mt containing 297.9 million lbs Cu and 656,000 oz Au (measured and indicated), and a further 40.2 million mt in the inferred category, for additional 319 million lbs Cu and 388,000 oz Au. "In these poly-metallic systems you are exposed to diversification very quickly. Having the gold credits is absolutely fantastic, I personally find these porphyry copper-gold systems very attractive,"

"The Pinaya property never had a high-level analysis to understand the relationship between the known skarn resource, the gold oxide prospect and the potential porphyry centers within the belt. The group that made the discovery focused on proving the resource, but the property is very big and could potentially host other porphyry centers, which typically appear in clusters."

**Tom Peregoodoff, president and CEO,
Kaizen Discovery**



declared Tom Peregoodoff, president and CEO of Kaizen Discovery.

Peregoodoff explained why, in his opinion, there is a discontinuity between the resource value and the market valuation of Pinaya: "The property never really had a high-level analysis to understand the relationship between the known skarn resource, the gold oxide prospect, as well as the potential porphyry centers within the belt. The group that made the discovery focused on proving the resource, but the property is very big and could potentially host other porphyry centers, which typically appear in clusters."

Finally, another upcoming player in the copper exploration segment is Pembroke Copper Corp., a private company established as a grassroots explorer eight years ago that is now moving along the Peco and Torurume deposits on the coastal porphyry belt in southern Peru, near Arequipa. At Peco, Pembroke has already earned-in a 51% interest from Trafigura after spending \$13 million, and through further expenditures it can earn an 80% stake. The actual resource at Peco is 612 million mt at 0.34% Cu plus gold, silver and molybdenum credits, at a cut-off grade of 0.25% Cu.

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Head Office
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Ted O'Connor
Chief Executive Officer & Director ted@plateauuranium.com

www.plateauuranium.com

Eugenio Ferrari

President, proEXPLO 2017



"Having deeper resolution in geophysics methodologies and improving drilling techniques, the land with potential will double."

What are proEXPLO 2017's main activities and topics of discussion?

The 10th edition of the International Congress of Prospectors and Explorers, proEXPLO 2017, will include sessions on geology and the exploration of copper, gold, silver and polymetallic deposits, as well as on the technological developments applied to exploration, like the use and modelling of remote sensing data, geophysics and geochemistry.

The event will include over 60 presentations and posters and central conferences led by renowned specialists. We will also have short courses and field trips. Finally, the program will also include environmental and social permits, valorization of exploration mining assets, corporate mining matters and financial aspects of the exploration business.

What is your opinion about the current state of the exploration market globally and in Peru?

Since early 2017, we have seen signs of recovery in the worldwide mining exploration sector, and Peru shows a similar trend. Peru has several competitive advantages against other Latin American countries, such as geological potential for different commodities and ore deposit types, competitive legislation, qualified professionals, local service companies with international standards, an organized mining cadastre system and large, unexplored land packages in the country. I am therefore optimistic about the future of mining exploration in Peru.

What can be done to help juniors companies carry out more exploration?

A junior mining company plays an important role in discovering new ore deposits. Unlike most mining companies, who focus on their brownfield or near-mine exploration budgets, junior companies are characterized by their ability to work in remote regions without adequate infrastructure, taking higher risks at an early stage and operating with small and qualified teams at very low operating costs. At present, most junior companies have difficulties to raise funds for their projects and the shortage of funds reduces their activities to exclusively maintain their claims and cover their fixed costs.

The government should simplify and speed up permitting processes, provide more information on social issues and offer tax

benefits to exploration companies. Currently, the over-dimensioned environmental regulatory framework for exploration and the absence of government representatives in the remote mining districts before and during the conflicts are the most important concerns for mining companies and investors.

What are the technological advancements in activities such as geophysics and drilling?

Over the last decades, other extractive and energy industries have made important progress to improve the technology applied to exploration. The mining industry is facing a similar transformation now, where technology is an important factor in the success of future exploration. For example, having deeper resolution in geophysics methodologies and improving drilling techniques, the land with potential will double, including areas with an important traditional exploration history.

At the "Technology applied to mineral exploration" session at proEXPLO 2017, we will have the participation of well-known professionals in the field of remote sensing processing, modelling of geophysics data applied to mining exploration, hyperspectral technology and other new-tech topics that will add value to exploration projects making them more efficient and less expensive.

"Exploration companies must realize that project success depends not only on the technical achievements, but also on the proper handling of other areas like corporate social management."

What can explorers do to improve the way they handle community relationships?

Exploration companies must realize that the project success depends not only on the technical achievements, but also on the proper management of several other areas, such as corporate social management. In my experience, a good outcome will depend on factors such as having a permanent team at the project, a good understanding of the social context since the early stages of the project, maintaining a proactive dialogue with the community and fulfilling commitments on time and in a proper manner. As simple as this may sound, most conflicts arise due to the lack of one, or more, of these factors.

It is important to include qualified community relations specialists as project members, who advise on the social aspects to the project manager. This will allow the company to generate a positive relationship with the community and prevent the risk of conflicts or project closure.

"Because of Pecoy's location at the coastal belt, the economics are much better than some of the other remote porphyry projects in the Andes where there is no infrastructure and you are a long way from the coast," commented Brian Booth, president and CEO of Pembroke Copper.

"Pecoy is going to be an attractive project for major copper producers because it has the size and the location to be a mine for a long time. We are at very low elevation and it is a desert, so no-one lives on our actual project area –that means no relocation will be required," he added.

This year, Pembroke has a budget of \$5 million to work on engineering studies at Pecoy and to start drilling the Tororume project, which is 100%-owned by Pembroke. With regards to the possibility of listing the company, Booth said: "We plan to stay private at this time, but we are completing all the paperwork that would be required if going public was a desire for us over the next year or two."

ZINC - A NEW OUTLOOK

A company that has benefited from the extraordinary run of the zinc price over the last few months is Tinka Resources. After the company's share price hit rock bottom in the first months of 2016, the market situation changed drastically for the better. Indeed zinc, that reached a peak of \$1.33/lb in February, had not traded at more than \$1.20/lb since 2008, noted Graham Carman, president and CEO of Tinka.

Last year, the company released a new resource for its Ayawilca project in Central Peru, with 18 million mt at a zinc equivalent grade of 8.2%, while it also ran initial metallurgical tests.

"We took the typical grade from a chimney at West Ayawilca, grading 7% to 10% zinc, and we obtained a 52% zinc grade concentrate with no pollutants. There is some iron associated with the sphalerite, but there are no penalties for arsenic or manganese. This first study was to see if we could produce a marketable concentrate, and the answer is yes, we can," said Carman.

While last year's resource estimate unveiled a potentially valuable tin component in the deposit, Tinka's focus right now is on the zinc. Carman added: "I think we are very close to the point where the project has enough tonnage already, but we want to make it more robust and prove there is potential for much more mineralization [...] The exploration objective this year is two-fold: to target a global resource of over 30 million mt, and to continue to add significant high-grade chimney-style zinc mineralization."

"Because of Pecoy's location at the coastal belt, the economics are much better than some of the other remote porphyry projects in the Andes. Pecoy has the size and the location to be a mine for a long time. We are at very low elevation and it is a desert, so no-one lives on our actual project area –that means no relocation will be required."



Brian Booth, president and CEO, Pembroke Copper

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(5% ZnEq cut-off grade)

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(0.76% Tin, 0.31% Copper, 18 g/t Silver)
(0.45% SnEq cut-off grade)

TINKA TARGETING ZINC RESOURCE EXPANSION IN 2017



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Photo courtesy of Plateau Uranium.

URANIUM AND LITHIUM

The uranium market has been low for a few years –even before Fukushima, the uranium price was on a downtrend. In this context, the market has seen a great deal of consolidation, and Peru was no exception. With the combination of Macusani Yellowcake and Azincourt Uranium, the resulting entity, Plateau Uranium, was able to build up a large uranium resource of 124 million lbs in the Macusani plateau in south-eastern Peru. Last year, Pla-

teau updated its PEA for a production model of 6.1 million lbs/y over 10 years, which would create one of the top five uranium mines worldwide. Now, the company is working on an updated PEA to incorporate the lithium component of the deposit as part of the operation as well.

“There is more lithium at Macusani than in the brine deposits of Argentina, Chile and Bolivia together,” affirmed Laurence Stefan, COO of Plateu Uranium. “Because of the low

grades, you have to look at it as a by-product, but as a serious by-product. Lithium gets extracted into the same solutions when uranium is dissolved –it is just a matter of deciding the route to extract lithium and what the final product is going to be: lithium hydroxide or lithium carbonate,” Stefan added.

Ted O’Connor, CEO of Plateau Uranium, assured that the fundamentals are very solid both for the Macusani project and the general uranium market, notwithstanding current low spot uranium prices: “Annual uranium demand is 170 million lbs, while mine supply is 150 million lbs, now going down to 135 million lbs [due to output reductions by Cameco and the Kazakhstan government]. Nobody can make money at the current prices, but the spot price is relatively insignificant because almost everything is contracted for the medium and long terms at prices closer to \$40/lb [...] The cash cost at our Macusani project, according to the PEA, is \$17.28/lb U3O8 including royalties.”

THE FERTILIZERS MARKET

Peru is already a sizeable producer of phosphate rock from the large Bayóvar operation in the Sechura desert in northern Peru. Developed by Vale, the operation has recently been acquired by Mosaic as part of Vale’s overall sale of its fertilizer assets.

The area hosts several companies developing phosphate rock projects hoping to feed the growing fertilizers market worldwide. These include Fosfatos del Pacífico (Fospac), a joint venture between Peruvian company Cementos Pacasmayo and MCAP (Mitsubishi and Zuari); Focus Ventures; and GrowMax Resources.

Focus Ventures’ Bayóvar 12 project is already quite advanced, with 58.8 million mt of proven and probable reserves. The pre-feasibility study for the project contemplates a \$167 million capex and the production of 1 million mt/y at 24/28% P2O5. Gordon Tainton, president of Focus Ventures, described the next steps for the project: “Moving towards feasibility, we have two main optimization objectives: the capital expenditure and the operational cost. We are looking at continuous mining, with the use of a bucket rotary wheel excavator system with integrated conveyors stripping off the waste burden. We are anticipating this will provide the project improved operational costs.”

Focus own 70% of the Bayóvar 12 project, while their partners JPQ hold the other 30%. The advantage here is that JPQ has a port nearby, which is a key component for the project. “Provided we obtain the financing, we are

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perhaps 30 months away from production,” affirmed Tainton, who also emphasized the high quality of the phosphate rock in the area: “The Sechura basin phosphate rock is known to be a highly reactive, slow-release phosphate rock. The company believes our product can be used as a direct application nutrient to specific tropical soil crops like palm oil, and also will be suitable for the traditional phosphate fertilizer product producers.”

Meanwhile, GrowMax Resources (previously known as Americas Petrogas) rebranded after selling its oil and gas assets in Argentina and is now well funded to advance its fertilizer business in Peru. The company has two projects in the Bayóvar area: on one hand, it has a potash resource in brine, and it is advancing the engineering for a pilot facility to produce 5,000 mt/y of sulphate of potash (SOP). The plan is to start construction this year and be in production in 2018. “The purpose of this demonstration facility is two-fold: firstly, the project will generate some cash and will pay for itself. Secondly, it will help us perfect the design for a much larger SOP project,” said Stephen Keith, president of GrowMax Resources.

Secondly, and similarly to Focus, the company is advancing a large phosphate proj-

“The biggest mistake by juniors in the fertilizers segment is that we tend to focus on the mining side of things, but that is just one piece of the puzzle. The real skill is to be able to sell the product. If this was a gold mine, you would be basically mining a bank account. In phosphates, it is completely different. Pricings and clients vary all over the place.”

**Stephen Keith, president,
GrowMax Resources**



ect, which already has a PEA for a 1 million mt/y operation with a grade of 30% P2O5., although Keith affirms that there is plenty of room for optimization: “We are very confident that we can significantly reduce the capex and and opex. Additionally, we want to look at other products such as direct application phosphate rock products that we can sell as an organic fertilizer, SSP, etc. We are also looking at a small starter mine with much lower startup costs, to be able to target the local market.”

All players across the segment have realized that the phosphate business is different than the traditional metallic mining project devel-

opment. The commercial component is key, this is why Fospac brought in Mitsubishi and Zuari as joint venture partners; and this is why Focus Ventures recently hired Gordon Tainton, an executive with decades of experience in the fertilizers business.

In the words of Stephen Keith of Growmax: “The biggest mistake by juniors in this segment is that we tend to focus on the mining side of things, but that is just one piece of the puzzle. The real skill is to be able to sell the product. If this was a gold mine, you would be basically mining a bank account. In phosphates, it is completely different. Pricings and clients vary all over the place.” ■

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Engineering: the 'Sponge' Factor

After significant downsizing and diversification, the mining-related workload will increase again for consultancy companies

During the boom years, consultants had their hands full. The large amount of projects in the market caused some headaches, such as the pressure on deadlines, human resources and salaries. Yet on top of the economic benefits of a buoyant business, the great advantage was that, for the most part, engineering players did not have to leave their desks to hunt for new jobs. "Work came straight to our door", remembered Alberto Coya, general manager of MWH, a company that recently merged with Stantec.

The last three years were very different. Big names in the engineering business had to downsize, create synergies within the different offices, look for new opportunities in new sectors and new countries, and develop commercial skills they had forgotten to be necessary.

"The market has changed a lot. During the boom years, it was relatively easy to carry out very profitable projects and mining clients paid high rates. Then, the low cycle forced clients to look for lower costs. We already hit rock bottom and we are going back to a bullish period, yet the market will not be the same as 10 years ago. Low costs will continue to be a requirement," said Denys Parra, general manager of Anddes, a firm created by former Vector Engineering staff that grew very rapidly and counts 220 people in Lima.

Federico Schwalb, general manager of Buenaventura Ingenieros (BISA), another local firm, shared a similar analysis: "The last high-price cycle lasted for very long and was unprecedented in this respect: we had 10 years of very high prices. Then we entered a low cycle in 2013, which has also lasted very long. Now, with prices improving and with the cost-reduction efforts made by the industry, we are seeing positive results again –not to the levels as in 2013, but decent still."

For companies in the bigger leagues that were used to handling large EPCM projects, the lack of new multi-billion projects meant a paradigm shift to make their businesses sustainable. SNC-Lavalin, for instance, had to restructure to serve its industries of interest more efficiently, while it also entered the environmental, social and permitting businesses working for both mining houses and junior companies –which was not an area of focus before. "We were primarily seen as a large EPCM projects company, but due to the lack of EPCM projects in the market, we have expanded our service offering," said Alexandra Almenara, general manager of SNC-Lavalin in Peru and vice president of Women in Mining's recently established Peru chapter.

In the case of MWH, even with the low cycle, mining still represents 85% of the Lima office's business, the remainder coming from energy projects. The company has traditionally specialized in wet infrastructure, and last year it completed two emblematic projects for one of the country's largest copper producers: a very large tailings dam, and a water treatment plant near the Chili river in Arequipa.

One of the strategies of MWH to offset the decrease of new mining jobs during the low cycle was to try to do work again for the public sector, namely in sanitation and irrigation projects, but the merger with Stantec is opening up new opportunities for the company in the mining sector as well. "Stantec has good expertise in underground mining in terms of reserve and resource calculation, energy for mining projects and ma-

terial handling," explained Alberto Coya. Stantec has actually chosen MWH's 140-strong Lima office as the base from which it will try to grow its underground mining offering in Latin America.

Similarly, the Lima office of SRK Consulting has also expanded its scope after the multi-national consultancy merged with SVS Ingenieros in Peru. Now fully rebranded as SRK Consulting, the company has added significant resource evaluation capabilities to the areas of practice previously available with the SVS team.

Antonio Samaniego, director of SRK Consulting in Peru, affirmed that the firm managed to minimize lay-offs in Lima during the downturn. "Over the last months, one of the areas that has seen increased demand is due diligence reviews for project transactions, for either the buyer, the seller or the bank putting up the money." The focus on cost reductions by miners also prompted consultants to produce numerous studies on operational efficiency, as Samaniego explained: "We have done many studies referring to mine services intended at controlling or lowering operating costs. Areas of focus included ventilation, dewatering and hydraulic backfilling."



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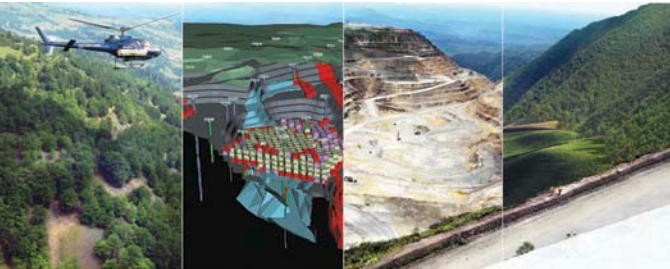
"As consultants, our challenge is to be at the forefront of technology and look at alternatives to include waste material as part of the mining process. Tailings are already being used as hydraulic or cemented paste backfill, or as part of the underground mining process. There are many success cases of this in Peru."



Alexandra Almenara, general manager, SNC-Lavalin

The decrease in metal prices put a number of underground mines in a difficult position, and some operators decided to introduce changes to the mining methods. Samaniego believes that companies can obtain good results as long as proper studies are done in advance: "Before embarking on a change of the mining method, companies should carry out a study of the behavior and geomechanical characteristics of the mine, otherwise you can drastically increase dilution and even create a global stability problem within the mine, making the operation uneconomic."

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FINALLY, EXPLORATION IS BACK

Mining Plus, an Australian consultant, is already feeling positive changes in the market. Paul Murphy, Mining Plus' manager for South America, said that not only the amount of work has been increasing over the last months, but the nature of the jobs is also changing: "In the last few years we have been working on many cost reduction and deferral projects, which continue to be important, but greenfield projects (scoping, pre-feasibility and feasibility studies) and regional exploration programs are coming back."

Within the mining food chain, exploration is the first segment to react to cycles. It is the first one to see its budgets cut off when the industry enters a low trend, and it picks up quite quickly when metal prices rebound. While companies often think that all money available should be spent on drill holes, Murphy recommends saving a small portion of the budget for a more strategic implementation of the drilling campaign: "There is nothing worse than having a 50 by 50 meter spacing when you should have used 40 by 40 meter spacing."

Murphy illustrated common problems associated to a lack of thinking: "We had a client who designed a drill program in 2D, only to find that the actual drill spacing on the vein was not as they thought it would be, leaving a big hole in the middle of the resource once the drilling was complete and the rig had left the site. What a nightmare! The bottom line is, take the little extra time to plan the program well and get the maximum tonnes converted for minimum meters drilled."

SOCIAL ISSUES

Exploration campaigns also involve engaging in community negotiations at a stage when the local residents may not see the difference between a major company and a junior player, generating expectations that are very difficult to manage. The mining sector is no longer the one of 30 or 40 years ago, when operators and engineers only had to define the technical aspects of a project. Today, the social factor is a key part of the equation, and consultancy firms have expanded their scope to assist clients de-risk the projects from this perspective.

POCH, a Chilean firm with 750 people across the countries of the Pacific Alliance, is working mostly on environmental and social projects in Peru, but it intends to use that base to grow its participation in the market in terms of its engineering capabilities. Francisco Rodríguez, the firm's general manager in Peru, highlighted the importance of a holistic view of social issues right from the start: "The success of a project can be clearly defined within the first months of relationship with the communities," he said. "Currently, between 12% and 15% of mining projects are facing social uprising by the adjacent localities or those in their area of influence. This is often explained by the companies' vision of dividing the project in silos. Companies must re-engineer their projects looking at the community from the beginning, rather than expect the community to adapt to the new scenario."

TAILINGS AND MINE CLOSURE WORK

The large volumes of water handled by mining operations, especially in large copper mines, prompts the question of how the industry should treat tailings and waste in general. Since the dam failures at Mount Polley and Samarco, consultants specialized in dam safety inspections have been very busy, monitoring dam conditions all over the world. Some people believe that it is time to move away from conventional slurry tailings, but the economics for alternative solutions can be very costly when involving large volumes.

"The decision to use conventional slurry tailings, thickened paste tailings or dry filtered tailings depends on a trade-off analysis specific to each operation. It is really site-specific," said Dan Etheredge, general



Alberto Coya, general manager, MWH (part of Stantec)

manager of Klohn Crippen Berger, a company that counts 200 people worldwide specifically dedicated to dam safety reviews.

Since the economic aspect is crucial to define the feasibility of using alternatives, consultants are thinking out of the box to make good use of the waste material. Alexandra Almenara of SNC-Lavalin said: "As consultants, our challenge is to be at the forefront of technology and look at alternatives to include waste material as part of the mining process. Tailings are already being used as hydraulic or cemented paste backfill, or as part of the underground mining process. There are many success cases of this in Peru."

Waste management also has to consider the future mine closure process. Peru is already seeing its first modern mine closures with Barrick's Pierina and Glencore's Tintaya, and the industry should see more of these over the next years. While these closure plans will require large expenditures in different supplies, such as chemicals for cyanide destruction in gold mines, engineering firms will also have to work on the best solutions to integrate the former mines within the ecosystem from many perspectives. "Mining companies are not very prepared because there is not that much experience. The industry has developed several strategies, technologies and ideas of how to face a mine closure, but these are plans that are still just on paper. What has been done already is to close a sector within a mine, both in underground and surface mines. Those experiences, either good or bad, should be shared by the different players," said Federico Schwalb of BISA.



Federico Schwalb, general manager, BISA



Photo courtesy of Hochtief.

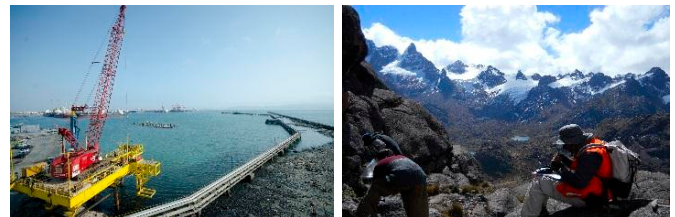
Donald Hickson, mining director for Latin America at Amec Foster Wheeler, currently being acquired by Wood Group for \$2.7 billion, anticipates the workload related to mine closure activities to increase significantly: "Tintaya and Pierina are both making efforts to close, in addition to Yanacocha, and we also recently won three contracts for Activos Mineros in remediation projects. Although there are water management challenges associated with closing a mine, we address the civil geotechnical component to offer physical and chemical stability as well as surface and ground water management," he said.

THE 'SPONGE FACTOR'

2017 will be a very interesting year as it could abruptly change market needs. At a Peruvian level, there are no large multi-billion investments coming up immediately, yet the increased level of activity on all fronts, from exploration campaigns to new project studies and from operational efficiency to environmental and social work, could mean that consultancy firms suddenly need to mobilize stand-by experts and hire again to respond to market needs. Mining is such a powerful industry in Peru that it has a 'sponge' effect, absorbing all resources available when the cycle is high. This could put an end to the shy diversification efforts by firms traditionally linked to the mining industry. Certainly, and despite all its flaws, many firms would be happy to see another mining boom over the next years. ■



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A More Integrated Offering

Mining contractors consolidate their market positions by expanding the scope of their services and their geographic reach

The recent wave of mining investments (\$42 billion between 2011 and 2015) is unlikely to be repeated. Up until the peak in 2013, it was a rosy period for engineering and construction firms, earthmoving contractors, installation specialists and metal-mechanic companies, among others. Today, however, a lot of the capex work has given way to opex activities, as mining operators need to handle substantial production processes. In this context, contractors have had to adapt. Opex work is less capital intensive and is probably less profitable than the large project construction work, but it offers the advantage of providing steady cash flow for providers. "2016 was not the best year for Peru's mining sector, but the industry is reactivating with improved metal prices and with the government efforts to promote project development. Besides construction work, through the OHL Industrial division we can also install large equipment and handle operation and maintenance contracts," said Ricardo Vega, president of the OHL Group in Peru, a Spanish-headquartered multinational construction firm.

Enlarging the scope of the service offering is also the key growth strategy for San Martín, a large local mining contractor which wants to posi-

tion itself as a full-service construction company and to rely less on its core business, contract mining. In this context, the company has gone beyond earthmoving and civil work to build plants, such as Moly-Cop's new production facility in La Joya and Buenaventura's Tambomayo processing plant. "Tambomayo was an emblematic project for us because we did everything from the earthmoving to the installation of the last piece of equipment that the plant needed to start operating," said Alfonso Brazzini, general manager of San Martín.

The company wants to increasingly participate in projects out of Peru, and is already working at First Quantum's Las Cruces mine in Spain, as well as in two limestone operations in Colombia.

Another contractor that has expanded its offering is MUR-WY. Part of Aruntani, the largest Peruvian private gold producer, the company was initially dedicated to support the different mines of the group through the rental and repair of equipment, but it has been targeting third-party business more aggressively over the last years, with a logistics and transport division that includes dangerous goods transportation and, more recently, an earthmoving division.

It is actually in earthmoving where the company sees better growth prospects, according to MUR-WY's general manager, Miguel Butrón: "Our largest project in earthmoving started in 2016 with the open-pit mining at El Brocal, where we have four large excavators and 70 dump trucks moving 100,000 metric tons of rock daily (mt/d), a figure that should increase to 130,000 mt/d this year. We have two other earthmoving contracts with Utunsa and Anama, part of the Aruntani Group."

Expanding the service offering is easier said than done; it requires large investments in heavy equipment, as well as a great deal of technical training and safety inductions for all the new employees. In this context, planning well in advance is a must: "With the improved metal prices, we

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José Antonio de Apraiz, territory director, OHL

anticipate sustained growth rates with more mining projects, so we must continue to invest,” said José Antonio de Apraiz, territory director of OHL Construcción. “In Peru, we have a fleet of more than 400 machines, including our own concrete and asphalt plants, as well as yellow equipment and ancillary equipment,” he added.

De Apraiz also highlighted that, as a multinational company, OHL can share know-how between the different countries where the company operates: “Additionally to our capacity in Peru, where we are more than 1,400 people, we have a presence in 30 countries, which gives us access to proprietary technology globally. Mining companies require strategic partners that can bring improvements and technological innovations, and our rapid response to complex problems is one of our distinctive features.”

Meanwhile, STRACON GyM, another large mining contractor, has now a 50-50 split between construction activities and contract mining. The largest construction project it is involved with right now is Cobre Panama in Central America for First Quantum. In Peru, there are no projects of that size under construction.

Part of the Graña y Montero Group, STRACON GyM is using the synergies with the sister companies GyM and GMI (for construction and engineering respectively) to provide a more integrated solution beyond earthmoving and contract mining services to clients throughout Latin America. In parallel to this, it is also targeting underground mining opportunities, such as the recent development of the San Ramón gold mine in Colombia for Red Eagle. Right now, underground mining only represents 6% of STRACON GyM’s revenue.

Steve Dixon, CEO of STRACON GyM, affirmed that underground mining should represent a bigger slice of the pie for the company in the future: “There is a natural progression in the region to have more large scale underground operations, as well as changes in the way some of the underground mines operate. This will present opportunities for larger, more sophisticated contractors like us. We already see opportunities with Codelco in Chile, while in Peru, operations like Antamina and Yanacocha could also develop an underground model. In some cases, underground mining is also a way to reduce social risks.”

STRACON GyM is not the only player eyeing the development of large-scale underground mining in Latin America. Byrnegut, one of Australia’s key contractors, also has plans to expand in the region following a presence of nearly two decades in the African market. To achieve this Byrnegut has signed a joint venture with San Martín, with bodes well with the Peru-

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Photo courtesy of Southern Peaks Mining.

vian company's efforts to diversify its offering. "Peru has many underground mines, but they are typically what we refer to as 'conventional mining', which is small-scale with tight tunnels, compact equipment, and more manually intensive work," described Greg Jackson, managing director of Byrncut Offshore. "As new mines emerge, companies will be looking for scaled-up versions with higher productivity, lower costs, and more mechanization or

automation resulting in less employees. The market we are tackling in South America is evolving," he added.

Jackson is aware that there are not many large underground projects that fit these characteristics right now, so their entrance to Peru is more of a five-year plan: "Our comparative advantage is that we are rapid developers that integrate strong safety and management systems to help clients

jump-start their mine, which is typically the first three or four years of a new operation. Byrncut can then either stay throughout production, or hand over the project to the owners if they want to be operators," Jackson said.

NICHE UNDERGROUND SERVICES

With its long history in underground mining, Peru is home to some specialized underground contractors that are also adapting to the evolution of the market. TUMI Raise Boring, for instance, is a technology developer and contractor specialized in raise boring services with a fleet of 13 machines working in Peru and a headcount of 300 people.

Traditionally focused on raise bore holes for ventilation, TUMI introduced a new machine, the SBM 400 SR, in order to get involved in production drilling. Marc Blattner, general manager of TUMI, gave more details: "With the SR model we provide a hole at the center of the blasting zone [...] A normal setup time for a raise bore hole is five to seven days. With our machines, we can do it in about 45 minutes. The SR model is very much like a jumbo; you connect it to the power, the machine levels itself up, pins itself into place and does its work." After a negative experience in Bolivia last year,

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the company is now targeting the Chilean market of box-hole services as a new opportunity for growth with a new machine that follows the same pattern of the SBM 400 SR. "Up until today, box-holing has used a very primitive technology. We are not trying to reinvent the wheel, we just want to use our experience to make the system much more efficient," explained Blattner, who believes that Codelco, with operations like El Teniente and Chuquibambilla, would be the perfect first client for this service.

One of the key areas of underground mining advancement is rock support, a segment where shotcrete application has become the standard in many Peruvian mines. Robocon is one of the key contractors offering the service and, similarly to TUMI, it also has in-house capabilities to design and build equipment to avoid relying solely on OEMs.

The company is currently expanding by more than 30% with two new contracts with Buenaventura at Uchucchacua and Tambomayo, which add to their presence in mines with Volcan and Pan American Silver, as well as their involvement at Yanacocha's exploration tunnels. Besides shotcrete application, the company has integrated vertically, implementing its own plants for the production of both

"Peru has many underground mines, but they are typically what we refer to as 'conventional mining', which is small-scale with tight tunnels, compact equipment, and more manually intensive work. As new mines emerge, companies will be looking for scaled-up versions with higher productivity, lower costs, and more mechanization or automation resulting in less employees."



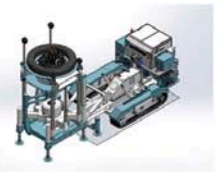
Greg Jackson, managing director, Byrncut Offshore

shotcrete and cemented backfill. Robocon currently employs 850 people.

By expanding its range of services, Robocon has been able to offer its clients a more competitive package. Enrique Sattler, Robocon's general manager, explained that the company is also evaluating covering the scaling phase of the shotcrete value chain, while the firm has also introduced the concept of the slick line to Peru; a vertical pipe that is being installed in Volcan's Chungar mine. The slick line takes the shotcrete from surface down 500 meters through gravity: "With this technology the client can save significant time and costs as-

sociated with the transportation of shotcrete by mobile equipment. There are several very deep mines in Peru where this solution can provide great savings," affirmed Sattler.

A flat market in underground mining activities since 2013 seems to be changing rapidly. Mining operators that had managed to reduce their costs to the very minimum are now opening up new fronts to make the most of better commodity prices. Contractors will need to keep up with this trend, expanding and renewing their fleets and training enough people to support the upcoming growth with quality services and a good safety record. ■



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After lots of repair and overhaul during the crisis, it is now the time to renew the fleets



Photo courtesy of Austin Engineering.

The global mining equipment market is projected to grow by 2.3% annually over the next years, reaching an estimated value of \$80.8 billion by 2021, according to a Lucintel market report. In Peru, after approximately three years of capital investment reductions, business for equipment providers is finally picking up.

The general halt in purchasing new machines in recent years means that various mines have to finally acquire new equipment. According to Richard Rodríguez, general manager of Sullair del Pacífico, the local distributor for Sullair's range of air compressors: "2014 and 2015 were

difficult years for the market of air compressors as companies were investing very little in renewing their machines. Instead, they were focusing more on maintenance and spare parts."

With 6,000 machines operating in the country, Rodríguez said that 2016 and the first quarter of 2017 already saw a significant improvement in terms of equipment sales and Sullair del Pacífico won a significant contract for Tambomayo's requirements of compressed air. "Mining will continue to be the main driver of our business. Although the investment in air

compressors is one of the lowest expenditures in a mining operation, it is still a crucial aspect of the mining process. We still see room for growth, not only in product sales but also in services," Rodríguez added.

Brian Doffing, president of Atlas Copco's surface and exploration drilling business and, until recently, the firm's general manager in Peru, commented that the trend of overhauling rather than buying had to end sooner or later: "Machines are not like wine; they do not become better with time. At some point there is a pressure point where the net present value of buying new equipment and obtaining lower operating and repair costs makes it more efficient for the clients to replace the old machines."

In this context, both Original Equipment Manufacturers (OEMs) and distributors with a strong presence in the market are preparing their operations to respond swiftly as demand for new units increases. The anticipation of growth has already sparked significant stocking efforts to avoid backorders, while new international players are also pushing to obtain a portion of the Peruvian mining pie.

As an example of the latter, Liebherr of Germany sees significant opportunities to sell its mining trucks in Peru, most notably the T 284 model with a capacity of 400 short tons (363 metric tons). The company's sales manager, Carlos Ballesteros, explained that during 2016, Peruvian mining operations acquired a total of 50 high-tonnage trucks with a capacity of 320 short tons or more. This, he says, proves that there are bright opportunities for new players to enter the market. "Several mines in the country, including Antamina, are currently looking into renewing part of their fleet, while other mines, such as Las Bambas, require more trucks for their expansion," Ballesteros said.

Increased metal prices will not translate into large new investment projects overnight, however, and thus many equipment companies continue to focus on the after-market



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segment. Austin Engineering, for instance, recently built a 3,000-square meter facility in Arequipa to provide maintenance and repair services in close proximity to clients in the region. In terms of new component sales, their star product is the truck body that can be fitted into an original Caterpillar or Komatsu mining truck. Since its establishment in Peru, the company has produced 120 of these locally, for clients including Hudbay, Antapaccay, Las Bambas and Southern Copper.

Austin is currently introducing the third generation of the JEC truck body to the Peruvian market, designed in Perth and called the JEC LD, which is being used by Rio Tinto globally and will also start working in mines in Chile and Colombia soon. "The new tray offers the client more payload based on less weight, optimized payload based on mine characteristics, reduced carry-back, reduced tail damage from berm dragging and stronger side wall protection," declared Tim Mitchell, general manager of Austin Engineering in Peru.

Mitchell emphasized that they are the only company manufacturing new truck bodies in Peru, while all the other players import them from plants elsewhere in Latin America.

In fact, manufacturing in Peru is somewhat unusual, yet local company Resemin is changing

perceptions with unprecedented growth as a Peruvian manufacturer of drilling jumbos for underground mining. Resemin saw its best year in 2016 with 62 machines sold, meaning a 25% increase in revenue according to Resemin's CEO James Valenzuela. Even though exports comprise 40% of total sales, Peru's mining sector is still key for their business and is seeing significant growth over the last months with the hike in base metal prices.

Resemin's Muki, an innovative 1.05 meter wide micro-jumbo, is used in narrow-vein operations in Peru and is already being sold in other countries. The company continues to expand its offering, having recently developed a scaler and a 1.30 meter wide bolter; yet Valenzuela assures that, after the Muki, the next transformational milestone will be Resemin's production of scoops, "a market three times the size of the jumbo business".

INNOVATION AS A PRE-REQUISITE

The competitive landscape in the mining market not only requires equipment to merely function, but also to add productivity to the clients' processes. These past years, with the dip in the market and with mining companies hesitant to purchase new equipment, providers needed to differentiate themselves

and maintain their edge through innovation. In 2017, trends in the technology market include: the introduction of battery-powered machines; the increased safety features of equipment; new maintenance tools to minimize downtime; and the continued tendency to achieve economies of scale, namely in very large open-pit operations.

Large OEMs, like Atlas Copco, are leading the charge in terms of the introduction of battery-powered equipment. While miners have seen mixed results with previous attempts to introduce this technology to their operations, Atlas Copco believes that the technology is already well developed and is bringing a battery scooptram to Peru this year.

Brian Doffing of Atlas Copco pointed out the advantages of the battery technology for underground operations: "Using battery power eliminates the need for diesel underground and the ventilation requirements that go with that. Most importantly for us in the Andean region is that electric motors do not suffer from inefficiencies like diesel engines do at high altitude. I imagine that within five to 10 years, 50% of the products will be battery-powered in Peru. The equipment is more expensive, but the operating cost is much lower and that is the whole value argument."



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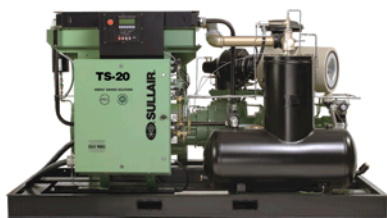
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It is not a question of if, but when will battery-powered equipment be the norm. The same goes with electronic systems capable of providing greater accuracy across industrial processes. A good portion of mining operators, however, still prefer machines that are simple, reliable and easy to repair. Kai Rothgiesser, division director of Bosch Rexroth, a large provider of hydraulic and other types of actuators, commented on this: "The trend towards the introduction of electronics is unstoppable, but in mining it is going to take longer. From our point of view, there are some applications that maybe do not need the level of accuracy and control that electronics offers. Electronics requires an environment that is not too aggressive with the machine, which is not the case in mining, especially in underground mining."

DATA FOR THE BIG PICTURE

Innovation is not only related to improving the technologies, but also to making the best use of the machines. Mining is a highly intensive activity and optimizing equipment productivity can bring enormous cost savings.

Franklin Pease, general manager of Normet, a Finnish manufacturer of underground equipment and best known in Peru for their Alpha 20 shotcrete spraying machines, affirmed that it is very important to look at the whole operational process when acquiring new equipment: "The focus on efficiency and productivity can never be lost. If a mine is spraying 1,000 cubic meters of shotcrete monthly, it is spending \$250,000 monthly on shotcrete value. By improving shotcrete application efficiency by 10%, the operator can save the whole cost of the machine in just one year."

Pease insisted that the impact is even bigger if you consider that a machine only lasts three years and that any mine has several of these running at any given time. Moreover, the sharp analysis of productivity must also be applied to maintenance, that Normet calls Life Time Care.

"There are several ways to improve operational efficiency, but you cannot control or improve whatever you are not measuring. Our NorSmart system allows the client to control efficiency through several parameters," Pease said.

Volvo is also taking further steps in terms of connectivity and operational management by providing consultancy services to clients on how to best use their equipment with the data that the Volvo systems already provide. "Volvo Trucks with Dynafleet and Volvo Construction Equipment with CareTrack have long been working with connected vehicles, but now we are taking the next step with a telematic solution that will include all our products," explained Marcus Hörberg, managing director of Volvo Perú. "This new system, together with our consultancy services, will provide a fantastic opportunity to make operations more productive, efficient and profitable."

This service integration comes along last year's strategic move whereby Volvo took over the Volvo Construction Equipment business in Peru, previously in the hands of a distributor. As part of this effort, the company has significantly expanded its service network in the country and is training 'hybrid' mechanics that can work both on Volvo's trucks and the brand's yellow equipment for construction. Between its Mack and Volvo trucks, the company has a 50% share in Peru's heavy-duty trucks market, while it also serves the mining and construction businesses with its buses and the Penta engines for power generating units (gensets).

UNDERGROUND SAFETY

A key factor affecting underground mines is safety. As compared to open-pit, underground mines suffer from more accidents of personnel and more fatalities. Indeed, mining fatalities increased in Peru in 2016, after several years of consistent decline. While working on safe behavior and a safety culture within organiza-

"Volvo Trucks with Dynafleet and Volvo Construction Equipment with CareTrack have long been working with connected vehicles, but now we are taking the next step with a telematic solution that will include all our products. This, together with our consultancy services, will make operations more productive, efficient and profitable."

Marcus Hörberg, managing director, Volvo Peru



tions is very important, developing new technologies is also a strategic step towards de-risking this type of mining activity.

TUMI Raise Boring, for instance, developed raise boring technologies to drill ventilation holes and to do slot raises used in underground mining production. "We have had zero accidents in two years, because the machine is fully automated," assured Marc Blattner, general manager of TUMI.

The push for better safety records is also coming from the regulatory framework. Last year, the government passed the supreme decree 024-2016 on safety and occupational health and this piece of legislation imposes more stringent standards for underground mining. "Decree 024 aims at consolidating the mechanization of the different processes in underground mining," pointed out Franklin Pease of Normet. "Now you need to use mechanized equipment to carry out certain jobs at height. Similarly, you cannot do the rock scaling manually anymore – a scaler is now required."

In this context, Pease sees good opportunity to increase the sales of Normet's machines for underground activities.

Decree 024 also demands a higher level of quality control and verification across all processes. As an example, it requires mining

"Using battery power eliminates the need for diesel underground and the ventilation requirements that go with that. Most importantly for us, in the Andean region, is that electric motors do not suffer from inefficiencies like diesel engines do in high altitude. I imagine that, within five to 10 years, 50% of the products will be battery powered in Peru."

Brian Doffing, president surface and exploration drilling, Atlas Copco



operators to test 20% of the bolts installed underground, a figure considered by some players as far too high from an operational perspective: "This requirement is not really feasible, because mines should put together specialized teams to run these tests or hire third party companies that provide this service. This could delay the mining process and increase production costs. In any case, we are qualified to provide the service," said Enrique Zambrano, commercial manager of DSI Underground, a rock support company that recently acquired the international operations of Jenmar.

PLANT TECHNOLOGIES

Another driving force behind innovation in the mining equipment market is the phenomenon of operations increasing to an immense scale. Huge mines require the adequate size of equipment to support the operation, thus companies are launching larger equipment. In mining trucks, the 400-short ton Caterpillar or Liebherr models available can bring efficiencies to Peru's mega-projects. In terms of processing equipment, companies like Metso have been launching increasingly large models to guarantee the lower cost possible per metric ton processed.

An advertisement for Atlas Copco's ST7 battery. The background is a close-up of a yellow battery pack. In the center, a white box contains the text: "HIGH QUALITY EFFICIENT SOLUTIONS", "Battery-powered. No emissions. No power cables. Safety, comfort and versatility.", the website "www.atlascopco.com.pe", and the slogan "Sustainable Productivity". To the right of the text is a small image of a yellow Atlas Copco loader. Below the loader is the Atlas Copco logo. In the bottom left corner, there is a "DANGER HIGH VOLTAGE UNAUTHORIZED PERSONNEL KEEP OUT" warning sign. On the right side, the words "ST7 BATTERY" are written in large, white, 3D-style letters.

Fernando Samanez, VP sales mineral processing solutions for the Pacific Rim at Metso, explained: “As volumes go up, you need to reduce the number of items, otherwise the plant becomes unmanageable. You cannot have 20 crushers, because you would need belts everywhere and the setup would be too spread-out.”

Samanez affirmed that Metso has been a pioneering company in the introduction of large-scale equipment, including the largest SAG mill in the world (42 feet) developed together with Newmont for the Conga project, which unfortunately never saw the light, and the world’s largest secondary ball mill (30 feet).

Beyond the better use of space, another aspect where large equipment can bring cost savings to miners is energy usage. “4% of the world’s energy consumption comes from comminution processes, which is huge,” affirmed Samanez. “To achieve better efficiency, you have to use digitalization and automation to better use voltage peaks, while you also need to design equipment that is more energy-efficient.” Samanez gave the example of the vertical mill, such as Metso’s VTM-7000, which uses 30-40% less energy than the equivalent ball mill.

NON-STOP PERFORMANCE

Money is time in the mining industry, and even more so as metal prices go up. Scheduled stops need to be as short as possible, while unscheduled stops have to be avoided at all costs. In Peru, with an installed capacity that has increased dramatically over the last years, specialized players have a great challenge to ensure the equipment’s maximum availability. Martin Engineering, a company dedicated to material handling solutions, recently launched two new developments contributing to better productivity. Eduardo Espinosa, commercial manager for the Andean region at Martin Engineering, gave more details: “On one side we launched the primary and secondary belt cleaners with in-line technology, that allows for changes and repairs even with the belt in operation. The other solution is the CleanScrape, a cleaning kit for conveyors that includes tungsten carbide tips and is maintenance-free. We already have two CleanScrape kits working in Peru and four in Colombia.”

Espinosa commented that there is a global trend in the market to promote the use of conveyor belt systems rather than mining trucks for the haulage of material. “Conveyor belts involve less people and present less risk, plus they generate fuel and power savings,” he said.



Eduardo Espinosa, commercial manager Andean region, Martin Engineering

This should ensure future growth for the company as new mines are built in the region. All in all, 2017 seems to be an exciting year for technology developments in the Peruvian mining industry. With the PERUMIN conference taking place in September, companies will be eager to present their latest developments to the public. Technological development and the Peruvian industry’s adoption of innovation will help forge the path of mining going towards the future: as technologies evolve, so will the mines. ■

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Mining Services

The market is not recovering for everyone yet, but the prospects are improving

With the uncertainties surrounding the general election and commodity prices, 2016 proved to be as equally stalled as 2015 for service companies. Therefore, in the mining services industry, companies have taken on the role of becoming optimal solutions providers. From drilling contractors to blasting providers to transportation and logistics companies, the whole value chain has felt the market pressure to become the problem-solvers for the industry.

Fortunately, company leaders can project some optimism, with businesses already picking up in market segments such as exploration, and better prospects for new project developments over the next months.

DRILLING

Geotec, a drilling contractor with more than 50 years of experience, has definitely felt the fresh start of 2017. Within the first month of the year, their fleet occupation has increased by 50% compared to 2016, and that is even more remarkable considering January is typically a slow month for drillers. "With certainty, this year the drilling market is going to expand by 30% to 40%, and the increment will be more acute in surface drilling, because in past years, 60% of the activity has centered around underground operations," commented Miguel Ángel Arenas, general manager of Geotec.

The company has recently incorporated six underground drilling rigs that are already working at Yanacocha. With more activity, the next natural step will be an increase in drilling rates, something that miners will try to delay as much as possible.

According to Arenas, margins continue to be low and that is a challenge for providers: "To offer a world class service, you need an efficient organization with certifications for quality, safety, environmental care and social responsibility. Even if there continues to be a pressure on rates to go down, we see new companies entering the market who probably do not realize the level of knowledge, safety, expertise and logistics required to fulfill the clients' objectives."

Another contractor that sees opportunity in the underground mining market is MDH, part

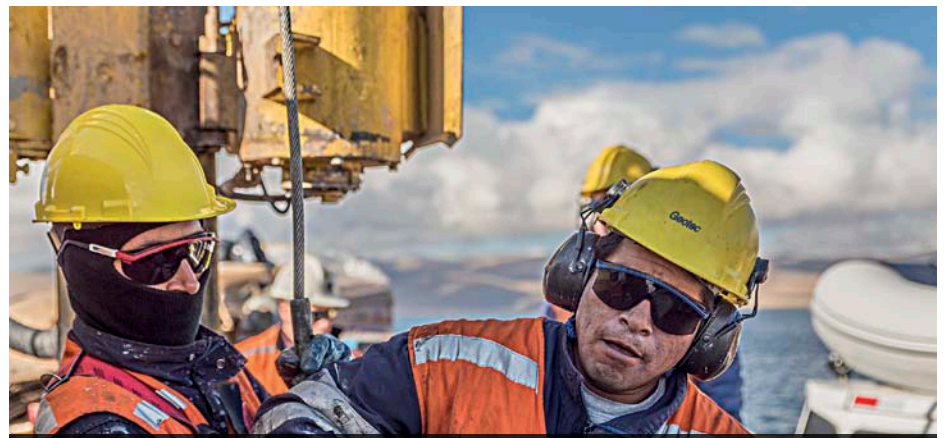
of the Aruntani group of companies. Previously a joint venture between Bradley and MDH, the company was taken over by the Peruvian shareholders when Bradley was sold to Major Drilling.

Ian Carlo Venero, general manager of MDH in Peru, anticipated the following developments in the drilling market: "We are going to see deeper holes in mining exploration, while underground exploration is going to represent a bigger part of the business in the future. In one of our underground projects we are already drilling 2,000 meter holes, while traditionally holes in these environments went to 800 meters in depth."

Venero added that the market will adopt fully-automated drilling rigs with rod feeders to eliminate the need for a helper manipulating the equipment and thus increase safety.

Indeed, mining companies are increasingly demanding with the sort of equipment that contractors have, both in terms of age and technical specifications. Spektra Drilling, a Turkish-headquartered drilling contractor with operations in the Americas in Canada, Mexico and Peru, fabricates all of its drills through its Delta subsidiary. The company has a small operation in Peru, with five machines currently working for Volcan.

"Having our own machines is a great competitive advantage because in Peru you have very few rigs that are track-mounted," said Radoslav Marinov, country manager of Spektra Drilling in Peru. "Our machines can be mobilized independently; you do not need a scoop that should otherwise be working in production, and this also provides environmental benefits."



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BLASTING

While many companies cut off exploration during the downturn, they could not stop production, so they put pressure on blasting solutions providers to bring rates down and have more productivity for lower costs. Short contracts, designed to keep a highly competitive market, means that explosives providers are participating in tenders pretty much all of the time: last year a large copper producer awarded a contract for just one year. “Our industry is still under pressure. Even if volumes have kept stable, the margins have decreased substantially,” lamented Gustavo Gómez Sánchez, general manager of Exsa.

Exsa, a Peruvian blasting solutions provider, managed to keep a good position through the introduction of the Quantex technology for open pit mines at a moment when the market was demanding cost savings. Gómez Sánchez explained: “The Quantex technology allowed us to grow in volumes. We closed 2016 with a 47% market share in open pit mining. Pretty much all of that is with Quantex, which means that the market has transformed very quickly. Indeed, the traditional heavy ANFO had been the market standard for the previous 25 years.” Exsa is opening up an operation in Chile, where it plans to start testing the Quantex technology



Eduardo Galdo, sales manager mining, Quimtia

with open pit clients this year. The company is also ramping up production of initiation systems at their brand new plant in Lurín, south of Lima, with the idea of capturing significant market share in a market worth \$75 to \$80 million annually in Peru.

Other rock fragmentation companies in the market include local company Famesa, Enaex of Chile and Orica, a multi-national player with a significant participation in open pit mining operations in Peru, with contracts currently with

Barrick, Cerro Verde and Las Bambas.

Asked about the search for efficiency, country manager of Orica, Gustavo Costa, said that choosing the right explosive can save significant costs to operators down the line, and gave the example of Orica’s Vistan/Vistis 250, an aluminum-based product that is 2.5 times more powerful than the conventional product: “The better the rock fragmentation, the more efficient the mineral processing will be at the plant, with energy savings. Blasting energy is eight to 10 times cheaper than the energy used in grinding, but it is not always easy to pass that message along to mining companies,” said Costa.

50% of Orica’s revenue in Peru actually comes from the provision of cyanide, a business the company decided to keep when it sold its chemicals division, and which is very important in Peru due to the large gold production of the country. In terms of initiation systems, the company is launching a new wireless detonator, which Costa expects to have an impact in underground mining, where advancing production fast is very important. Costa assures that, depending on the results of this year’s tender processes, Peru could become the number one country for Orica in the region. In preparation for that, the company doubled its capacity at the Congata plant (Arequipa) last year.



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Fernando Martínez, general manager, Avis

CHEMICAL SUPPLIES

The significant increase of Peru's copper output is creating opportunities for Quimtía, a supplier of chemicals. Traditionally geared towards the gold market through the distribution of cyanide in bulk, the company is now moving towards a closer relationship with the client, becoming involved in more value-added specialty products for flotation processes as well as solid-liquid separation solutions. "We are focusing on these two areas because they are the future due to the increasing demand from concentrators and flotation systems on one side, and the growing importance of water recovery on the other," said Eduardo Galdo, mining sales manager at Quimtía.

The company is also involved in environmental and mine closure efforts, with the provision of hydrogen peroxide for the destruction of cyanide in more than 30 mines in the country. In the mineral production process, the maturity of some gold oxide mines is also creating new demands, said Galdo: "Gold and silver mineralization is becoming more complex. You have transition zones with mineralization that contains gold, but also sulphides and other metals that make extraction more difficult. This requires the use of much more cyanide, new equipment, new thickening systems or changing the process altogether."

FLEET MANAGEMENT

Avis, a provider of corporate renting services that entered the Peruvian market just a few years ago under the management of Mare-auto, has been consolidating its operation and already has a fleet of 1,200 vehicles, with clients across the mining and construction value chain. The plan is to reach 1,500 vehicles by the end of 2017, and start bidding for large fleets. "We still do not have large fleets in the mining sector because, as a medium sized company, we did not want our business to depend on

one large client," said Fernando Martínez, general manager of Avis. "It is not easy to build up a sales and after-market platform for clients this size, and renting vehicles to the mining industry is not easy because they put a lot of wear and tear on them. Today, however, we could participate in a bid for fleets of up to 300 pick-up trucks, because we already have experience with workshops within the mines, and we have also implemented mobile workshops at the request of clients," he added.

Martínez insisted that there is enormous room for growth for the renting business in Peru, considering the very low penetration figures of renting in the country: renting vehicles represent less than 1% of the total vehicle fleet, and just 6% of the new vehicles sold in the market are used in renting, as compared to 17% in Spain.

LOGISTICS

Investments are a sign of a healing market, and mining service companies can expect increased growth as more mining projects become activated. However, providers will need to address the pressure from the industry to consolidate more services in order to compete in the market.

To compensate the lack of new project work, transportation and logistics company Stiglich expanded its services to assist clients on more fronts. They physically moved their operations to a 20,000 square meter facility, which includes 5,000 meters for storage and project cargo handling, and it currently offers general freight services, as well as the traditional oversized cargo services.

Carlos Roldán, until recently general manager of Stiglich, commented that mining companies are not getting the most of their logistics chain: "Today, we have a buyers market, and this does not encourage mining companies to share their plans in advance. The demand-of-fer dynamics are like that, but this has a negative consequence, because providers cannot minimize the costs of the services [...] With a more fluid collaboration, everyone would benefit from increased efficiency."

Those who have seen many cycles will say that, once the market comes back, all the talk about efficiency will be gone because very few mining companies keep the financial discipline when they are just trying to grow and push production. Surely, while the beginning of 2017 has meant an upturn in business for mining services companies, the market is not at that level yet, so this year companies will have to keep a strong focus on operational efficiency and competitive rates, while they also prepare for increased market demand. ■

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Augusto F. Cauti

Executive Director,
Australia Peru Chamber of Commerce
(APCCI)



"There is room for deeper collaboration between Peru and Australia in mining education and training."

What is APCCI's positioning in the mining sector?

The Australia Peru Chamber of Commerce has been active in Peru for five years now. We focus most of our efforts on the mining, infrastructure, education and tourism sectors. In general, we promote business and commercial opportunities, and bilaterally we bolster foreign trade and investments between Peru and Australia. We also help our members position their brands and businesses within the country. The Chamber consists of companies from Peru, Australia and other countries. Our board of directors is currently chaired by Rio Tinto.

What are your main objectives for 2017?

We are organizing a series of events and conferences around different economic sectors, as well as professional networking events. Particularly in mining, we provide support to important events in our country such as ProExplo, Perumin, the International Gold & Silver Symposium and the Mining and Investment Latin America Summit. We will also continue our online publications with news about the commercial and investment ties between Peru and Australia. This is still a growth period for APCCI in Peru.

How can Peruvian and Australian companies share best practices to improve efficiency and safety?

Australia has a highly developed pool of providers to the mining industry in segments including mineral processing, equipment and technology, and also has well-known mining clusters. Besides, there is room for deeper collaboration between the two countries in education and training in the mining sector. In Australia you find many universities and institutes that have set up centers of excellence for mining and specialized

training facilities. In this respect, the Academia has worked together with the private sector and the government to form a virtuous triangle, which Peru should replicate. Australia, which set the foundations of its development on the mining sector, is the number 2 of 188 countries and territories according to the UNDP's Human Development Index ranking.

Many Australian juniors are looking for mineral deposits in Latin America. How important is it to create a business-friendly regime for exploration in Peru?

Over the last years, Peru's GDP growth can be attributed to large scale projects such as Las Bambas, Toromocho and Cerro Verde. At this point, there are no mega-projects ready to be built, and this is a big challenge for the country. Low commodity prices, social conflicts and the delays to obtain permits have affected the exploration business. In fact, in many aspects exploration is treated the same way as production from a legal perspective, and this drains the explorers' resources. The new government has an opportunity to improve the legal framework to promote junior exploration.

How do you see Peru's mining industry evolving?

For the mining industry to take off again, the government needs to be present in the remote areas where mining takes place; to invest as soon as possible in human development initiatives, namely education and health; and to build infrastructure to provide opportunities around the mining operations, including the development of mining clusters. We cannot wait for a new super cycle to make these decisions. By 2018, if metal prices are higher, as a number of analysts predict, Peru would then be in a better position to ride the wave of new mining investments.

This publication is a pre-release edition of GBR's full special report on Peruvian mining, that will be published in Q3 2017.

If you wish to be interviewed for the report, please contact Imara Salas (isalas@gbreports.com)

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Senior Project Director: Alfonso Tejerina
Project Coordinators: Imara Salas, Laura Brangwin, Alice Pascoletti
Reporters: Alfonso Tejerina, Camila Moscoso Román
Executive Editor: Mungo Smith
Graphic Designers: Özgür & Deniz
Operations Director: Miguel Pérez-Solero
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